where needed within riparian areas. These activities represent the vegetation management activities most likely to be implemented in riparian corridors. Levels of these activities would vary across alternatives (Table 3-48), affect only a small proportion of the riparian corridor, and would be implemented where such conditions are lacking. Prescribed fire also may occur within riparian corridors, most often as low intensity backing fires as necessary to use streams as control lines. Because of their low intensity, these fires are not expected to substantially alter vegetation or leaf litter conditions. Where riparian corridors support fire-dependent communities (e.g., canebrakes), prescribed fire may be used more purposefully to periodically maintain these communities.

Table 3-48. Expected levels of vegetation management activity (in acres) within riparian corridors for the purpose of providing vegetation diversity for riparian dependent biota, by forest plan revision alternative, Sumter National Forest.

	Alternative						
Management Activity	A	B	D	E	F	G	I
Acres of Canebrake Restored in 10 Years of Plan Implementation	0.1	0.2	0.1	0.1	0.1	0.1	0.2
Acres of Canopy Gap Treatments in 10 Years of Plan Implementation	1.0	5.0	1.0	5.0	0	0	3.0
Percent of forestwide riparian corridors maintained in early successional habitats in 10 years of Plan implementation	1.5 – 3.7%	0.9-1.9%	1.8-4.4%	1-2.5%	n/a	0.3-1.4%	1.2-2.7%

Implementation of the riparian prescription under all alternatives is expected to increase the acreage within riparian corridors that is in late-successional forest (Tables 3-50 and 3-51) as a result of allowing forests in these areas to age. Increases in older forests would result in increases in abundance of snags and downed wood, important habitat components for many riparian dependent species. It would also result in abundant and well-distributed habitats characterized by shaded, low-disturbance, moist-soil microsites, which are preferred habitat for other species. Small amounts of the riparian corridor would be intentionally set back in succession to create breeding, stop-over, or wintering habitat for riparian associated species. Small amounts of cane dominated sites (canebrakes) and wetlands (moist soil to shallow water habitats) would also be restored. Some sites would be thinned or harvested to improve structural diversity, mast production, or restore plant communities to species found in bottomland or riverfront forest. Overall, trends are expected to create a distribution of some early but predominantly late-successional forest within the riparian corridor (Tables 3-49, 3-50, 3-51). Patches of created early-successional habitat are not expected to diminish the role of riparian areas as landscape corridors because of their small size and relative rarity, and their occurrence within a predominately mature forest matrix.

Table 3-49. Expected percent of riparian acreage in early-successional forest conditions on the Sumter National Forest, after 10 and 50 years of implementing forest plan alternatives. (derived from SPECTRUM models)

	Mountains		Piedmont	
Alternative	Year 10	Year 50	Year 10	Year 50
Alternative A	1.5	3.7	1.5	3.7
Alternative B	0.9	1.9	0.9	1.9
Alternative D	1.8	4.4	1.8	4.4
Alternative E	1.0	2.5	1.0	2.5
Alternative F	n/a	n/a	n/a	n/a
Alternative G	0.3	1.4	0.3	1.4
Alternative I	1.2	2.7	1.2	2.7

Table 3-50. Expected percent of riparian acreage in mid- and late--successional forest conditions on the Sumter National Forest, after 10 and 50 years of implementing forest plan alternatives. (derived from SPECTRUM models)

	Mountains		Piedmont	
Alternative	Year 10	Year 50	Year 10	Year 50
Alternative A	>92	>83	>92	>83
Alternative B	>88	>84	>88	>84
Alternative D	>91	>80	>91	>80
Alternative E	>88	>82	>88	>82
Alternative F	n/a	n/a	n/a	n/a
Alternative G	>98	>94	>98	>94
Alternative I	>90	>84	>90	>84

Table 3-51. Expected percent of riparian acreage in late-successional forest on the Sumter National Forest, after 10 and 50 years of implementing forest plan alternatives. (derived from SPECTRUM models)

	Mountains		Piedmont	
Alternative	Year 10	Year 50	Year 10	Year 50
Alternative A	>67	>72	>63	>74
Alternative B	>63	>73	>60	>74
Alternative D	>67	>51	>65	>71
Alternative E	>63	>71	>59	>73
Alternative F	n/a	n/a	n/a	n/a
Alternative G	>71	>82	>66	>83
Alternative I	>65	>73	>61	>74

Many species – beaver, raccoon, muskrat, wood duck, colonial nesting birds, bald eagle, wood stork, osprey, kingfisher, water thrush, wading birds, turtles, salamanders, and frogs would benefit most from Alternatives B, E and I. For the Acadian flycatcher, the direct and indirect effect of all alternatives would be positive. Analysis indicates that, under all alternatives, in 50 years the riparian corridors would move toward the desired condition for the Acadian flycatcher, i.e., mature to older-aged forests. Acadian flycatcher populations are expected to follow trends in mature riparian forest due to the close association between this species and habitat type. Breeding densities in suitable habitat average 14.5 pairs per 100 acres, with high densities reaching 43 pairs per 100 acres (Hamel 1990: C-5). Population trends for this species are tracked by annual breeding bird surveys (BBS) and bird point counts conducted on the Sumter National Forest.

Cumulative Effects

Cumulatively, networks of riparian corridors across landscapes containing National Forest System land in South Carolina have been fragmented by mixed ownerships and land use conversion. This condition is expected to persist across all alternatives into the foreseeable future.

Alteration of riparian areas from conditions needed to support dependent species is most prevalent along larger rivers and streams, which (except for the Chattooga River) are disproportionately under private ownership. Historically these sites likely provided the best quality habitat for riparian dependent species and an especially large proportion of the landscape's early-successional riparian component due to their use for Native American agriculture. Today, these sites on private land are likely to provide large expanses of open conditions in the riparian habitat due to private land management actions, but it is more likely to be cultivated ground or improved pastureland and habitat quality cannot be assumed. Many of the riparian areas in these land-uses are no longer suitable for either early- or late-successional riparian dependent or associated species.

It is not expected that private landowners will restore or manage to maintain significant amounts of high quality riparian habitats, including canebrakes or wetland habitats, and they would remain limited in abundance on the landscape without national forest maintenance and establishment efforts. Expected trends for riparian areas on national forest land – moving toward mature forest dominance with a small component maintained in early-successional habitat and development of wetland complexes along river corridors – would contribute to sustaining breeding, migratory, and wintering populations of riparian dependent or associated species on the landscape.

Snags, Dens, and Downed Wood

Affected Environment

Large woody debris (including branches, large logs, stumps, and root wads) is an important habitat component both to streams and terrestrial areas. It is important both structurally and as a source of nutrients.

Large snags provide birds with nesting and feeding sites, singing perches, and as lookout posts for predators and prey (Howard and Allen 1988). Bats roost and produce maternity colonies under exfoliating bark. Amphibians, reptiles, small mammals, and invertebrates utilize woody debris as cover. Animals use snags, logs, and stumps as denning sites.

Downed wood and logs are used for drumming by grouse to attract mates. Turtles and snakes use logs in streams and overhanging branches for basking and sunning. Large woody debris in riparian areas is used as cover by amphibians, insects and other invertebrates, and small mammals. Small mammals utilize logs as travel ways. Fungi and other decomposers of woody debris are key components of food webs. Rotting wood tends to absorb moisture during wet periods and release it in dry periods, thus helping to maintain a cooler microclimate (Ernst and Brown 1988; Knutson and Naef 1997).

Within the stream system, downed wood from riparian trees and shrubs greatly influences channel morphology and aquatic ecology. By obstructing streamflow, large woody debris stores and distributes sediment and creates channel features such as pools, riffles, and waterfalls. Wood also traps organic matter, which allows this material to be processed by instream organisms. Fish and insects occupy the pools and riffles created by the large woody debris, and riparian forest regeneration occurs on deposited sediment (Lassettre and Harris 2001).

Den trees, defined as living trees with hollows or cavities inhabited by animals, also are a critical habitat component for many species. They are used for nesting, roosting and hibernating. Many species of potential viability concern are associated with snags, downed wood, or den trees (Appendix F). Hunter (1990) states that little information is available on how much large woody material is sufficient to support associated species. He cites literature that reviews expert opinion on snags, with a recommendation of 2-4 snags per acre being a "reasonable target."

With the exception of the large amount of small diameter dead and decaying wood in sapling/pole stands, snags and downed wood are typically most abundant in late-successional forests. Current abundance of late-successional forest by community type is shown under the section on successional forests. Snags and downed wood also may be abundant in forests affected by mortality events such as storms and insect and disease outbreaks. Fire may reduce snags and downed wood in fire-dependent communities, but is also known to cause some tree mortality, which in turn creates new snags and eventually, downed wood. Alternatives vary by the amount and frequency of prescribed burning opportunities (Tables 3-52 and 3-53).

Table 3-52. Estimated average annual acres (m acres) of prescribed burning by alternative and plant community (mountains)

MOUNTAINS

Community Type	Fire return interval (years)	A	B	D	E	F	G	I
Dry-Mesic Oak	10 to 35	0.5	1.0	0.5	1.4	0.9	0.5	1.0
Dry and Xeric Oak	3 to 10	0.3	1.0	0.2	0.8	0.2	0.2	0.5
Shortleaf Pine/Pitch Pine/Pine-Oak (all mixed types)	2 to 10	2.5	4.5	2.2	3.5	1.0	1.1	3.6
Loblolly Pine-Oak (Dry & Dry-Mesic Oak-Pine in part)	10 to 35	1.6	2.6	1.8	2.6	1.9	0.9	1.7
Table Mountain Pine (Pine & Pine-Oak in Part)	6 to 10	0.3	0.3	0.2	0.3	0.3	0.2	0.3
Mountain Longleaf Pine (Pine & Pine-Oak in Part)	6 to 10	<0.1	0.1	<0.1	<0.1	0.1	<0.1	0.1
Grass Dominated communities	2 to 10	0.5	0.4	0.1	0.6	0.1	851	4002
Total **Average Annual**	-----	**5.6**	**9.6**	**5.0**	**9.3**	**4.5**	**2.9**	**7.4**

Table 3-53. Estimated average annual acres (m acres) of prescribed burning by alternative and plant community (Piedmont)

PIEDMONT

Community Type	Fire return interval (years)	A	B	D	E	F	G	I
Dry-Mesic Oak	10 to 35	0.8	1.6	0.8	2.5	1.7	0.8	1.7
Dry and Xeric Oak	3 to 10	0.3	0.4	0.5	1.3	0.3	0.3	0.8
Shortleaf Pine/Pitch Pine/Pine-Oak (all mixed types)	2 to 10	0.6	2.2	1.3	1.3	0.3	0.3	1.3
Loblolly Pine-Oak (Dry & Dry-Mesic Oak-Pine in part)	10 to 35	12	18	11	18	12	5.8	12
Grass Dominated communities	2 to 10	0.4	1.6	1.0	1.2	0.7	0.2	0.6
Total **Average Annual**	-----	**14.0**	**23.4**	**15.1**	**23.9**	**14.9**	**7.5**	**16.1**

Acres in late-successional forest conditions are one indicator of the presence of these habitat elements because of their relative abundance in this successional stage. The pileated woodpecker (*Drycopus pileatus*) is selected as the wildlife management indicator species for snags, dens, and downed wood. It requires large cavity trees for nesting and forages on dead trees and downed logs across a variety of community types (Hamel 1992:190). Population trends of this species are tracked by annual breeding bird surveys (BBS) and bird point counts conducted on the Sumter National Forest.

Direct and Indirect Effects

Forestwide direction under all alternatives states that unless necessary for insect or disease control or to provide for public and employee safety, standing snags and den trees would not be cut or bulldozed during vegetation management treatments unrelated to timber salvage. For timber salvage treatments, all live den trees and existing snags (up to 5 per acre from the largest size classes) would be retained. Distribution of snags and live residuals may be scattered or clumped. Live den trees would not be used for snag creation, but could count toward live residuals.

Forestwide direction for potential black bear den trees under all alternatives states that den trees would be left during all vegetation management treatments occurring in habitats suitable for bears (Andrew Pickens District only). Potential den trees are greater than 20 inches DBH and hollow.

With these provisions included under all alternatives, existing snags, downed wood, and den trees would be well maintained on Sumter National Forest land. It is reasonable to predict that with these management provisions combined with the continuous creation of more habitat through aging age-class distributions, most alternatives (except for possibly A, D, and F) will result in an increasing abundance and improved distribution of these habitat elements over the next 50 years. Increased mortality of trees due to forest health threats potentially would increase abundance of snags and downed wood regardless of management approaches (see cumulative effects discussion below). Den trees are also expected to increase in abundance as forests age. However, restoring an abundance of large diameter den trees will require several decades of forest growth in many forest community types found in the Blue Ridge and Piedmont physiographic areas.

Because of their dependence on large snags for nest sites, pileated woodpecker populations are expected to follow trends in snag availability and persistence on the forest. Population trends, therefore, should be positive under all alternatives.

Cumulative Effects

In the Piedmont of South Carolina, national forest lands are expected to provide a disproportionately large share of high quality habitats for species associated with snags, downed wood, and den trees. This result is expected because of the distribution of older forests on national forest compared to private lands (see section on Mix of Early and Late Successional Forests). This disparity is expected to increase over time as other land uses and market conditions for forest products affect the age, composition and structure of forests on private lands.

Forest health threats also are expected to substantially add to cumulative effects on these habitat elements, by increasing tree mortality. The increasing number of biological threats and increasing severity of effects in recent years has created an abundance of snags and downed wood in many locations across the Sumter National Forest. This trend is expected to continue into the foreseeable future as forests age and biological threats expand their zone of influence (see section on Forest Health). While national forest management can reduce the severity of tree mortality in some locations, forest health threats are nevertheless expected to have a substantially positive effect on abundance and distribution of snags and downed wood under all alternatives. Den trees, which generally need longevity to become high quality habitat elements for wildlife, are likely to be negatively affected by forest health threats.

Watersheds and Aquatic Habitats

Affected Environment

On the Forest, the Andrew Pickens Ranger District contains portions of seven 5th level watersheds that drain to the Savannah River. These include the Chattooga River, Chauga River, Coneross Creek, Upper Keowee Composite, Little River Composite, Tugaloo River Composite and Whitewater River Composite. Forest Service ownership is greatest within the Chauga and Little River watersheds at 42% and 16% respectively. There are 4,426 stream kilometers (2,751 miles) on the District. Ownership is disjunct with private inholdings throughout the watersheds. The majority of the streams are classified as cool water habitats, with headwaters consisting of cold-water fish species. Approximately 49 species of fish occur among these watersheds. Forest sensitive species include one mussel and one crayfish

The Enoree Ranger District in the Piedmont contains portions of fourteen 5th level watersheds that are within the Santee-Cooper drainage. These include Upper Broad River Composite, Browns Creek, Sandy River, Lower Broad River Composite, Little River, Middle Tyger River Composite, Fairforest Creek, Lower Tyger River Composite, Middle Enoree River Composite, Duncan Creek, Indian Creek, Lower Enoree River Composite and Middle Saluda River Composite. The Lower Broad River Composite, Middle Tyger River Composite, Lower Tyger River Composite, Middle Enoree River Composite and Lower Enoree River Composite watersheds were rated as high vulnerability in a conservation assessment of National Forests for the Southern Region (McDougal 2001). The high vulnerability rating for these watersheds is associated with a mixture of factors including rare species composition; high human population increase; and medium public interest. Forest ownership is greatest within the Indian Creek and Lower Enoree River Composite watersheds at 48% and 44% respectively. Ownership is disjunct with private inholdings throughout the watersheds. This pattern of ownership is typical throughout the District. There are 8,576 kilometers (5,330 miles) of streams on the District. All of the streams are classified as warm water habitats. There are approximately 54 species of fish that occur in these watersheds; one classified as a Forest sensitive species.

The Long Cane Ranger District is also located in the Piedmont. It contains portions of seven 5th level watersheds that drain to the Savannah River. These include Little River Composite, Little River, Long Cane Creek, Lower Savannah Composite, Upper Stevens Creek, Turkey Creek and Lower Stevens Creek Composite. The Upper and Lower Stevens Creek watersheds were rated as high vulnerability in a conservation assessment of national forests for the southern region (McDougal, 2001). Forest Service ownership is greatest in the Lower Savannah Composite at 30% and Long Cane Creek at 27%. Ownership is disjunct with private inholdings throughout the watersheds. This pattern of ownership is typical throughout the District. There are 6,840 kilometers (4,252 miles) of streams on the District. All of the streams are classified as warm water habitats. The Upper Stephens Creek and Turkey Creek watersheds contain the richest diversity of mussel species on the Forest, including one federally listed species. There are approximately 39 species of fish located in all the watersheds; one classified as a Forest sensitive species.

There are 34 hectares (85 acres) of warm water pond and small lake habitat located on the Forest across the three districts. These waters are managed for recreational fishing opportunities.

Federally listed and Forest Service sensitive species that occur on or near the Forest are listed in Table 3-54. These species have been addressed in the EIS Aquatic Viability Analysis (Chapter 3).

Table 3-54. Federally listed threatened (T) and endangered (E) aquatic species and Forest Service sensitive (S) aquatic species on the Sumter National Forest.

Scientific Name	Common Name	Status
Alasmidonta varicosa	Brook floater	S
Cambarus chaugaensis	Oconee stream crayfish	S
Etheostoma collis	Carolina darter	S
Lampsilis splendida	Rayed pink fatmucket	S
Lasmigona decorata	Carolina heelsplitter	E

Management Indicator Species are addressed in the MIS Process Record. Changes in aquatic communities will be used to assess Forest management activities on the aquatic ecosystem. Fish populations are monitored on a rotational basis across the Forest in cold, cool, and warm water stream habitats. Species composition and abundance reflect changes that may occur in stream populations. In addition, the aquatic insect community will be used as a monitoring tool to determine management activity effects on stream systems. Warm water pond habitats are monitored on an annual basis for the purpose of managing a recreational fishery for the public.

Direct and Indirect Effects

Soil disturbance and loss of riparian vegetation remain the largest threats to aquatic habitats in watersheds of the Sumter National Forest. Soil disturbance adds sediments to streams that were highly impacted by past farming and logging practices. Road and trail crossings contribute sediments to streams and can inhibit the movement of aquatic organisms within the stream system. Loss of riparian vegetation compromises large woody debris and leaf litter contribution to the aquatic system, shading for stream temperature maintenance, and the filtering capacity of the riparian area for sediments.

The Riparian Corridor Prescription, (Appendix C) which addresses perennial and intermittent streams, and the Forest Wide Standards (Chapter 2 FW-4 through FW-14) specific to ephemeral channels should mitigate most direct and indirect effects associated with aquatic resources across all action Alternatives. Riparian corridor mapping will occur on a site-specific basis and will address aquatic habitat improvement needs. Implementation of guidelines associated with the riparian corridor should further minimize effects of land management activities. Where recreation and timber prescriptions are emphasized in alternatives, the number of road and trail stream crossings may increase. Any direct or indirect effects from these activities should be short term and may impact individuals, but should not affect aquatic populations. Harvest within the riparian area for canopy gap associated wildlife habitat, waterbird habitat development and canebreak restoration comprise 5,600 acres, or 10 percent of riparian area across the Forest under Alternative I. The total acreage for these activities increase for Alternatives B and E for canopy gaps, Alternative E for waterbird habitat development and Alternatives B and G for canebreak restoration. The total acreages decrease for Alternatives A, D and G. These activities have the potential of impacting aquatic resources through soil and vegetation disturbance and fish passage barriers. All these activities will be analyzed and mitigated on a site-specific basis.

The Riparian Corridor Prescription is a component of all action alternatives. Riparian areas and aquatic resources are managed to encourage the processes that maintain or lead to a desired future condition for fisheries and aquatic habitats. Riparian habitats and fisheries are sustained in a healthy condition. Soil disturbance is minimized and road and trail crossings are maintained to protect aquatic resources and allow movement of aquatic species in the stream system. Vegetation management occurs only when needed to protect or enhance riparian-associated resources. Large woody debris input increases stream habitat diversity as riparian vegetation matures. Current management practices such as aquatic species stocking and restoration and habitat improvement and enhancement may be suitable. These practices incorporate low soil disturbance activities and any negative effects should be minimal impact and short term. Implementation of the Riparian Corridor Prescription should have beneficial effects on aquatic resources.

Other prescriptions associated with action alternatives have the potential to affect fisheries management. For those alternatives that propose additional recommended wilderness study area acreage (Chapter 3, Prescription 1B), there should be no effect on trout management in watersheds of the Andrew Pickens Ranger District. The Wilderness Management Handbook (Exhibit 1-9) states that species of fish traditionally stocked before wilderness designation may be considered indigenous if the species is likely to survive. The SC Department of Natural Resources will continue to stock trout species in these waters.

Cumulative Effects

Direct and indirect adverse effects to aquatic communities are minimized by the Riparian Corridor Prescription and Forest Wide Watershed standards; however, they are not eliminated from the entire watershed. Cumulatively, Forest Service activities may contribute to sediment in the watershed.

Clingenpeel (2002) developed a process to estimate sediment yield and analyze the cumulative effects of proposed management actions on water quality and aquatic species viability at the 5th level watershed scale. The process predicts sediment yields as a surrogate for determining cumulative impacts to water quality and specifies a Watershed Condition Rank (WCR) for each of the 28 5th level watersheds under each of the seven alternatives (Table 2). The WCR is at a scale that does not reflect the mitigation effects of Riparian Corridor Prescription implementation. The WCR in each watershed was consistent for all seven alternatives. Possible Watershed Health Indices are Excellent, Average, and Below Average. Forest objectives are determined by the WCR and their related potentials for affecting aquatic resources.

If the WCR is scored Excellent (E), the probability is low for adverse effects to aquatic resources. Excellent watershed objectives are to maintain or improve aquatic health through the implementation of the Riparian Corridor Prescription. On the Sumter National Forest, four watersheds are ranked as Excellent. Average (A) denotes the potential to adversely affect aquatic resources as moderate. In addition to maintaining and improving aquatic health, objectives for Average watersheds include conducting watershed assessments at the project level and pre-project monitoring efforts to determine actual biota health. Twenty 5th level watersheds have a WCR of Average on the Sumter National Forest. Where a watershed WCR is below average (BA), the potential to adversely affect aquatic resources is high In addition to the objectives stated for Excellent and Average watersheds, the focus in Below Average watersheds include maintaining and restoring watershed health and aquatic systems on a project level, where the Forest Service can make meaningful contributions to the watershed health. Opportunities may include partnerships with other landowners to improve overall watershed condition. Four watersheds were assigned a Below Average index in this process.

Plan management direction is to maintain, restore, and enhance riparian and aquatic habitat. The Riparian Corridor Prescription addressing perennial and intermittent streams and the Forest Wide Standards specific to ephemeral channels will be implemented across all action Alternatives. Watersheds with an Excellent WCR score remain Excellent for all action alternatives, and therefore there should be no adverse cumulative effects on water quality with respect to aquatic resources for those watersheds. Watersheds with Average and Below Average WCR scores also remain Average and Below Average across all action alternatives. For these watersheds, additional watershed assessments and surveys should be conducted to determine the sources of impairment and prescribe appropriate treatments when they occur on National Forest lands. As a result, no additional adverse effects to water quality or aquaitc species should occur.

Table 3-55. Watershed condition for forest plan alternatives on the Sumter National Forest (period-1). Ownership is the percentage of the watershed managed by the SNF. Current WHI is the watershed health index score. Risk 1 indicates watershed impairment; however, the Forest Service may influence conditions to improve the watershed. Risk 2 also indicates watershed impairment; however, Forest Service opportunity to measurably affect the watershed is limited. Sources of risk: S = sediment; P = point-source pollution; T = temperature; F = altered flow.

Watershed	Ownership	WCR	Watershed Condition			WCR						
HUC	%	Current	Low Risk	Risk 1	Risk 2	Alt-A	Alt-B	Alt-D	Alt-E	Alt-F	Alt-G	Alt-I
305010601	26.255	A			S	A	A	A	A	A	A	A
305010602	0.535	A			S	A	A	A	A	A	A	A
305010603	0.746	BA			S	BA	BA	BA	BA	BA	BA	BA
305010604	1.083	A			S	A	A	A	A	A	A	A
305010605	7.326	A			S	A	A	A	A	A	A	A
305010607	0.003	A			S	A	A	A	A	A	A	A
305010705	16.627	A			S	A	A	A	A	A	A	A
305010706	3.181	BA			SP	BA	BA	BA	BA	BA	BA	BA
305010707	31.367	A			S	A	A	A	A	A	A	A
305010802	23.185	A			S	A	A	A	A	A	A	A
305010804	23.521	A			S	A	A	A	A	A	A	A
305010805	48.860	A	-		S	A	A	A	A	A	A	A
305010806	44.153	E	X			A	A	A	A	A	A	A
305010915	0.068	A			S	A	A	A	A	A	A	A
306010102	9.505	E	X			A	A	A	A	A	A	A
306010103	0.716	E	X			E	E	E	E	E	E	E
306010105	15.747	A			S	A	A	A	A	A	A	A
306010108	3.351	BA			S	BA	BA	BA	BA	BA	BA	BA
306010201	13.689	BA		S		BA	BA	BA	BA	BA	BA	BA
306010208	10.315	A			S	A	A	A	A	A	A	A
306010212	41.725	A		S		A	A	A	A	A	A	A
306010310	3.718	A			S	A	A	A	A	A	A	A
306010314	5.932	A			S	A	A	A	A	A	A	A
306010315	26.735	A		S		A	A	A	A	A	A	A
306010603	30.477	E	X			E	E	E	E	E	E	E
306010701	8.633	A		S		A	A	A	A	A	A	A
306010702	15.318	A		S		A	A	A	A	A	A	A
306010704	13.400	A		S		A	A	A	A	A	A	A

Threatened, Endangered, and Sensitive Species

Affected Environment

The Sumter National Forest provides habitat for eight federally threatened and endangered species and 30 Forest Service sensitive species, including one candidate for federal listing (see Appendix E for complete listing). Sensitive species are designated by the Regional Forester and include species occurring on the forest with rangewide viability concerns, but which are not included on lists of endangered, threatened, proposed, or candidate species. Sensitive species receive special management emphasis in order to ensure their viability and to preclude trends toward federal listing or endangerment. Of the species groups represented on the forest's threatened, endangered, and sensitive species (PETS) list, there are five birds, three mussels, one salamander, one crayfish, one fish, one butterfly, two bats, and twenty-six plants.

Effects of alternatives on threatened, endangered, sensitive species (PETS), and locally rare species were included in the viability analysis associated with the forest plan (see section on Species Viability). Effects of forest plan implementation on threatened, endangered, and sensitive species are more thoroughly discussed in the biological assessment (BA; see Appendix F). A review of affected environment and significant direct, indirect, and cumulative effects for threatened, endangered, and candidate species, including species on county lists obtained from the U.S. Fish and Wildlife Service (for counties containing national forest land), but which are not likely to occur on the forest, are also addressed below.

Pool Sprite (Amphianthus pusillus)

Pool sprite is a small, federally threatened aquatic winter annual plant restricted to eroded depressions or (rarely) quarry pools formed on flat-to-doming granitic outcrops in Alabama, South Carolina, and Georgia (Recovery Plan for Three Granite Outcrop Plants, p.5). The species appears to be intolerant of competition, inhabiting microsites which are nutrient poor with very shallow soils. Pool sprite is known to occur near monocultures at extensive grantic outcrops located within 50 miles of the national forest, including Heggie's Rock Preserve (owned by the Nature Conservancy) in Georgia and Forty Acre Rock Heritage Preserve in South Carolina. The species, where it occurs, typically flowers in February and March and continues to flower until the microhabitat is desiccated by spring droughts (sometime from March to May), killing the plants (Recovery Plan for Three Granite Outcrop Plants, p.7). Seeds remain dormant either on or within the soils through summer and germination begins in late autumn and peaks in winter. The species is not known from the Sumter National Forest and is not likely to occur there due to the lack of known extensive granitic outcrops occurring on the forest and therefore, lack of suitable habitat. Small granitic outcrops are known from the forest, but no pool sprite is known from these sites and habitat is of low quality.

Bald Eagle (Haliaeetus leucocephalus)

The bald eagle ranges over most of the North American continent, from as far north as Alaska and Canada, down to Mexico. Experts believe that in 1782 when the bald eagle was adopted as our national bird, their numbers may have ranged from 25,000 to 75,000 nesting pairs in the lower 48 states. Since that time the species has suffered from habitat destruction and degradation, illegal shooting, and most notably from contamination of its food source by the pesticide DDT. In the early 1960s, only 417 nesting pairs were found in the lower 48 states. In 1999, more than 5,748 nesting pairs of bald eagles were recorded for the same area, resulting primarily from the banning of DDT in the United States in 1972 aided by additional protection afforded under the Endangered Species Act (USDI, Fish & Wildlife Service, 1999).

Bald eagles have few natural enemies but usually prefer an environment of quiet isolation from areas of human activity (i.e., boat traffic, pedestrians, or buildings), especially for nesting. Their breeding areas are generally close to (within 4 km) coastal areas, bays, rivers, lakes, or other bodies of water that reflect general availability of primary food sources including fish, waterfowl, rodents, reptiles, amphibians, seabirds, and carrion (Andrew and Mosher 1982; Green 1985; Campbell et.al. 1990). Although nesting territory size is variable, it typically may encompass about 2.59 square kilometers (Abbott 1978). Most nest sites are found in the midst of large wooded areas adjacent to marshes, on farmland, or in logged-over areas where scattered seed trees remain (Andrew and Mosher 1982). Two bald eagle nests are known from the Sumter National Forest: one nest near the Savannah River on the Long Cane District, and one on the Broad River on the Enoree District.

*Carolina Heelsplitter (***Lasmigona decorata***) Lea*

The Carolina heelsplitter was federally listed as endangered on June 30, 1977 (U.S. Fish and Wildlife Service 1996). The species was historically known from several locations within the Catawba and Pee Dee River systems in North Carolina, and the Pee Dee and Savannah River systems and possibly the Saluda River system in South Carolina (U.S. Federal Register 2002). More recent inventories indicate the species has been eliminated from the majority of its historic range, and that only six populations are known to exist (U.S. Federal Register 2002). Two of these populations occur on the Long Cane Ranger District of the Sumter National Forest (U.S. Federal Register 2002; U.S. Fish and Wildlife Service 1996).

Critical habitat, designated in July 2002, includes stream reaches within the two units on the Long Cane District of the Sumter National Forest, which contain the Turkey Creek/Mountain Creek/Beaverdam Creek population, and the Cuffytown Creek population (U.S. Federal Register 2002). These reaches correspond to streams occurring within the Turkey Creek watershed and the Upper Stevens Creek watershed, respectively. The greatest threats to the Carolina heelsplitter include pollutants in wastewater discharges, habitat loss and alteration associated with impoundments, channelization, and dredging operations, channel and streambank scouring associated with increased stormwater runoff, and the runoff of silt, fertilizers, pesticides, and other pollutants from various land disturbance activities with inadequate-to-poorly maintained erosion and stormwater control (U.S. Federal Register 2002; Alderman 1998). Based on various riparian zone functions compiled from as many as 1500 sources of literature, maintenance of a significant wooded riparian corridor is critically important to the survival of the Carolina heelsplitter (Alderman 2002).

Smooth Coneflower (Echinacea laevigata)

Smooth coneflower, a federally endangered species, is a plant of roadsides, open woods, barrens and glades, utility rights-of-way, or other sunny situations, usually in association with calcium- or magnesium-rich soils underlain by mafic rock (Gaddy 1991) Smooth coneflower is known to occur in Georgia, South Carolina, North Carolina, and Virginia, but has been reported historically from Pennsylvania, Maryland, Alabama, and Arkansas as well. Based on information summarized in the recovery plan (April 1995) of 24 surviving populations, seven populations occur on national forest land (South Carolina, Georgia, Virginia), nine occur on private land, and the remaining eight occur under various federal or state ownerships (U.S. Fish and Wildlife Service 1995). The recovery objective for classification from endangered to threatened is 12 geographically distinct, self-sustaining (stable or increasing for 10 years or more) populations.

On the Andrew Pickens Ranger District of the Sumter National Forest, smooth coneflower occurs at eight geographically distinct locations, based on the most recent data. Historically, much of the species' habitat was xeric woodlands, savannas, or grasslands that were maintained in an open condition by fires caused by lightning or Native American burning (Davis et.al. 2002). On the Sumter National Forest, all sites for smooth coneflower occur along roadsides, at least in part. Habitat management, including canopy opening and prescribed burning, on at least three of the sites for several years has resulted in stable populations.

*Florida Gooseberry (***Ribes echinellum)**

Florida gooseberry was designated a federally threatened plant species in August 1985. Florida gooseberry was known from only one population in Florida for several years (FDR 29338, July 1985). A second population was located in McCormick County, South Carolina, in 1957, a site which eventually received protection as a South Carolina Heritage Preserve. Disjunct sub-populations were located in proximity to the second site in McCormick County, including six subcolonies which were found on the Sumter National Forest, Long Cane Ranger District, in 1987. The Long Cane sub-population is located on mesic hardwood forests adjacent to Stevens Creek, and consists of six subcolonies (Forest Monitoring Data, 1998).

Habitat for the species in South Carolina is deciduous, basic mixed hardwood forests, dominated primarily by oaks and hickories (TNC 1987), with sweetgum, hophornbeam, and species indicative of calcium-rich soils such as Florida sugar maple and basswood. The soil pH at the South Carolina site is 6.7 to 7.4 (TNC 1987). The plant appears to be threatened most by habitat alteration associated with development, logging, or severe fire (USFWS 1978). Competition with invasive non-native plants, such as Japanese honeysuckle, have threatened the South Carolina site (TNC 1987; Forest Monitoring Data 1998).

Georgia Aster (Aster georgianus)

Georgia aster, a candidate for federal listing, is a plant of roadsides, open woods, cedar barrens, utility rights-of-way, or other sunny situations, and appears to be adaptable to dry open habitats independent of soil type. Georgia aster is known to occur in North Carolina, Georgia, South Carolina, and Virginia. Based on data from 2001, Georgia aster occurs at 12 geographically distinct sites on the Sumter National Forest, including 10 on the Enoree and two on the Long Cane, some consisting of more than one subpopulation. All sites occur along roadsides, and population ownership is typically shared with the state highway department or respective utility company. Most of the populations occurring on the Sumter National Forest are declining or at low numbers, with the exception of two. This is likely due to competition with successional vegetation or drought. Historically, much of the species' habitat was xeric woodlands, savannas, or grasslands that were maintained open by fires caused by lightning or Native American burning (Murdock 1995; Davis et.al. 2002).

*Persistent Trillium (*Trillium persistens*)*

The persistent trillium was listed as federally endangered in 1978. Known populations are restricted to the Tallulah-Tugaloo River system in Rabun, Habersham, and Stephens Counties, Georgia, and Oconee County, South Carolina. The trillium appears to be restricted to gorges and steep ravines (USFWS 1984). Habitat is variable, with plants occurring primarily in mixed pine-hemlock forests where they are often associated with *Rhododendron maximum*, or in mixed oak-beech forests (Patrick et.al. 1995). The persistent trillium population in South Carolina is located on private land (USFWS 1984). No populations are known from the Sumter National Forest, but potential habitat does occur there. Threats to the species include recreation use in the form of trails and camping (T. Patrick, pers. commun, USFWS 1984), collection pressure, wildfire, and residential development (USFWS 1984). The species cannot withstand disturbance, and populations on state land near previous trails appear to be flourishing now that the trails have been closed (T. Patrick, pers. commun).

*Piedmont Bishop Weed (*Ptilimnium nodosum*)*

Piedmont bishopweed, or harperella, was designated a federally endangered plant species in September 1988. Based on information in the recovery plan (1991), the species consists of 13 known populations in seven southeastern states. Four of seven historically known populations were confirmed in 1989 (Recovery Plan, p.15), from Aiken, Barnwell, and Saluda Counties. No populations are known from national forest land. In Maryland, West Virginia, North Carolina, Alabama, and Arkansas, the species occurs in seasonally flooded rock streams (Recovery Plan, p.1). All seven of the South Carolina populations occur in coastal plain ponds (Carolina bays). This habitat type is not likely to occur on the Sumter National Forest. Based on the species' distribution, a small chance of encountering habitat might occur on the Long Cane Ranger District.

Red-cockaded woodpecker (**Picoides borealis*****)***

The red-cockaded woodpecker (*Picoides borealis*) is a federally listed endangered species endemic to open, mature and old-growth pine ecosystems in the southeastern United States. Currently, there are an estimated 12,500 red-cockaded woodpeckers living in roughly 5,000 family groups across twelve states. This is less than 3% of estimated abundance at the time of European settlement (USFWS 2000). The red-cockaded woodpecker was listed as endangered in 1970 (35 Federal Register 16047) and received federal protection under the Endangered Species Act of 1973. The precipitous decline in population size that led to the species' listing was caused by an almost complete loss of habitat. Fire-maintained old-growth pine savannas and woodlands that once dominated the southeast no longer exist except in a few isolated small patches.

In 1986, seven populations of red-cockaded woodpeckers existed on national forest lands in SAA forests (Costa and Escano 1989). Red-cockaded woodpecker populations were on the Bankhead NF, Cherokee NF, Conecuh NF, Daniel Boone NF, Oakmulgee Division (of Talladega NF), Oconee-Hitchiti NF, and Talladega Division (of Talladega NF). Red-cockaded woodpeckers once inhabited the Sumter National Forest, but have not been observed there for over 20 years (personal observations, Forest Service personnel) and are now considered extirpated from the forest. The Sumter National Forest is not included in recovery plans or strategies, including the *FEIS for the Management of the Red-cockaded Woodpecker in the Southern Region* (USDA-FS 1995), nor the USDI Draft Revised Recovery Plan (U.S. Fish and Wildlife Service 2000).

Relict trillium (Trillium reliquum)

Relict trillium is a federally endangered species of basic mesic hardwood forests occurring on soils that contain a high level of organic matter and medium to high levels of calcium. The largest and most vigorous populations are located in the lower piedmont/fall line sandhills province, in drainages of both the Savannah and Chattahoochee Rivers of Georgia and South Carolina. Relict trillium is known to occur from 21 populations (U.S. Fish and Wildlife Service 1990) in Alabama, Georgia, and South Carolina, but none of the populations occur on national forest land. Primary threats to the species are loss of habitat resulting from urban development, and in some cases, competition with invasive non-native species, logging, species conversion, or fire (TNC 1990). Although no populations are known from national forest land in Alabama, South Carolina, or Georgia, habitat is known to exist there.

*Small whorled pogonia (***Isotria medeoloides***)*

The small whorled pogonia was listed by the U. S. Fish and Wildlife Service (USFWS) as endangered in 1982 and revised to threatened status in 1992 based on discovery of new sites, achievement of protection for many of the sites, and additional life history and population information (U.S. Fish and Wildlife Service 1992) written for the species. Small whorled pogonia is known from 16 states, including Virginia, West Virginia, North and South Carolina, Georgia, and Tennessee (NatureServe 2001). The Sumter National Forest has four existing sites for small whorled pogonia, though eight were known historically (Gaddy 1985). Numbers of individuals at each site range from 1 to 45 according to forest monitoring data dating back to 1985. Colony sizes and stem counts of the species fluctuate widely year-to-year, a fact that makes viability assessment difficult and which is also noted in the 1992 Recovery Plan.

This species is found primarily in second and third-growth deciduous and mixed-deciduous/coniferous forests. Ages of the older trees on the sites vary from as young as 30-years-old in South Carolina to 80-years-old in Virginia. The forest habitat in which this orchid is found is not rare, yet only a small percentage of the habitat has colonies of small whorled pogonia. Site characteristics are highly variable, but are usually mesic, with sparse to moderate ground cover and a relatively open understory canopy. Old logging roads or streams are often nearby. Many sites show signs of past agricultural use (USFWS 1992, pers.obs).

Wood Stork (Mycteria americana)

The United States breeding population of wood storks is listed as an endangered species. This species may have formerly bred in all the coastal southeastern United States from Texas to South Carolina. Currently, they breed throughout Florida, Georgia, and coastal South Carolina. Post-breeding storks from Florida, Georgia, and South Carolina occasionally disperse as far north as North Carolina and as far west as Mississippi and Alabama. The estimated total population of nesting storks throughout the southeastern United States declined from 15,000 to 20,000 pairs during the 1930s to a low of between 4,500 and 5,700 pairs for most years between 1977 and 1980. Since 1983, the U.S. population has ranged between 5,500 and 6,500 pairs. Factors contributing to the decline include loss of feeding habitat, water level manipulations affecting drainage, predation and/or lack of nest tree regeneration, and human disturbance (U. S. Fish and Wildlife Service 1996).

Portions of the piedmont on the Sumter National Forest are used as late summer foraging areas by post-breeding storks that disperse from the nesting areas (Gary Peters and

Donna Ray, personal comment). There are no known nesting or roost sites on the Sumter National Forest. The closest nesting colony is in Georgia just south of the Savannah River Site, at least 100 miles to the southeast. On the Sumter, wood storks forage in small wetlands, including beaver ponds and small streams. Use of most feeding areas is short-term and the use of any individual area varies from year-to-year depending on water-levels and the availability of forage fish. The use of these sites as foraging areas is dependent on the availability of appropriate water levels during late summer, which to a great degree is dictated by weather conditions.

Direct, and Indirect Effects

All alternatives include the general goal of contributing towards the recovery of federally-listed threatened and endangered species (T&E). Additionally, the following activities are common across all alternatives, with the exception of Alternative F (current management):

- Recovery plans (when available) will be followed for all T&E species.
- Forestwide habitat or population objectives for all threatened, endangered, candidate, and other species with viability concerns on the forest will be followed to recover the species or prevent federal listing.
- Several forestwide and management area standards and allocations will conserve species and or associated habitat.
- Threatened, endangered, and sensitive species will be addressed and conserved through the site-specific biological evaluation process.

Direct effects to threatened, endangered, or sensitive species are unlikely across all alternatives, and would not likely jeopardize the continued existence of threatened and endangered species, or effect viability for sensitive species.

Several management prescriptions facilitate the conservation of habitat for threatened, endangered, and sensitive species habitat across all alternatives with the exception of Alternative F, current management. The riparian prescription (MP 11), with its emphasis on low levels of disturbance and maintenance of aquatic and riparian values, conserves habitat for the aquatic PETS such as mussels, crayfish, and fish, and several rare plants. The rare community prescription (9F) and associated goals and forestwide or prescription-level standards, will provide optimal habitat conditions for the majority of PETS species. This prescription will also be applied across all alternatives with the exception of Alternative F. Habitat for the Carolina heelsplitter will receive additional consideration through the designation of the Turkey Creek and Upper Stevens Creek Management Area in Alternative I.

Several PETS species, including smooth coneflower and Georgia aster, require active management to create open, grass-dominated woodlands preferred by the species. All alternatives strive to create conditions required by woodland-associated species.

Other restoration-oriented objectives, such as restoration of shortleaf pine and conditions for oaks on the piedmont, will provide additional habitat benefits for species associated with them.

As a result of implementing all alternatives with the exception of Alternative F (current management), there are likely to be beneficial indirect effects to habitats for all PETS, though the magnitude of the habitat benefits will vary somewhat across alternatives. Benefits are likely to be greatest under Alternative B, which emphasizes biological restoration; Alternative G, which emphasizes T&E habitat and watershed restoration; and Alternative I, based on the management area allocation for watersheds containing the federally endangered Carolina heelsplitter. Benefits to PETS would be less under Alternatives A, D, and E, and least under Alternative F, current management.

Cumulative Effects

The Sumter National Forest has an ownership pattern that is highly fragmented by private land. Based on a broad scale watershed assessment for the forest (Hansen 2002), only three 5th order watersheds, of the twenty-seven 5th order watersheds identified, contain over one-third of their area in national forest. This fragmented ownership pattern can limit landscape level efforts required for some PETS species, especially wide-ranging species, those associated with aquatic habitats, or those requiring landscape-level restoration processes such as the use of prescribed fire.

Public land plays a critical role in the conservation of federally listed plants, which receive no protection on private land, and all T&E habitats, which receive no protection on private lands, and sensitive species, which receive no protection on private land. During the next 10 to 50 years of forest plan implementation, human populations are likely to expand, affecting urbanization, roads and associated traffic, and the use of the national forests by humans. This suggests the public land will play an increasingly important role in the conservation of threatened, endangered, and sensitive species in the future, but that management to ensure recovery and/or prevent federal listing of species will be an increasingly difficult challenge.

All forest plan alternatives contain goals and forestwide standards, and are subject to laws, regulations, and Forest Service policy requiring the conservation of threatened, endangered, and sensitive species. This suggests that the cumulative effects of implementing all alternatives will be beneficial.

Demand Species

Northern Bobwhite

<u>Affected Environment</u>

Northern bobwhite numbers have declined steadily throughout their range for over 40 years and quite likely, for much longer. From 1980 to 1999, fall bobwhite populations declined 65.8% and projected trends indicate a further decline of approximately 53.9% over the next two decades (Dimmick et.al. 2002).

A lack of nesting and brood-rearing cover is considered the major limiting factor over much of the range of the northern bobwhite. The loss of native warm season plant communities by planting non-native grasses, planting dense pine forests, and intensive production of row crops is principally responsible for limiting bobwhite populations as well as other species such as loggerhead shrike, dickcissel, bobolink, Henslow's sparrow, Bachman's sparrow, and field sparrow. Managed warm season grasses with an adequate component of forbs provide good to excellent nesting and brood-rearing habitat. Southern pines can be managed to encourage development of habitat conditions favorable for northern bobwhite. Hardwood forests provide important winter habitats for bobwhite throughout much of its range. Hardwood savanna management provides habitat conditions that promote bobwhite productivity and survival.

Northern bobwhites have specific seasonal needs that vary throughout the year. This species favors abandoned fields and brushy areas such as wood margins, hedgerows, thickets, and open woods (Hamel 1992). Summer nesting cover and summer brood habitat consisting of grassy areas (preferably bunch grasses) and weedy patches with exposed bare ground are needed to provide for the recruitment within a population. Winter food and winter cover of seed producing plants and shrubby thickets are needed to carry populations through the dormant season (Rosene 1985). Habitat conditions for bobwhite quail require disturbances from burning and mowing or discing on 2 to 3 year intervals.

Good northern bobwhite habitat requires good interspersion of food species and cover that is not too dense. Good habitat can support about one bird per acre (2.5/ha; Murray 1957). In a habitat improvement experiment in Florida, pine forests were cleared and subterranean clover (*Trifolium subterraneum*) planted to encourage the establishment of arthropods, an important food for chicks (Ribbeck 1987). Areas that were sharecropped and burned during winter and spring at 2-year intervals produced more quail than areas planted with food patches or areas that were sharecropped but not burned (Ellis 1969).

Rosene (1969) recommended managing forests on an uneven-aged rotation basis, and thinning after 20 years to maintain an open canopy. He also suggested creating park-like woodlands in the South with high open canopies and a thin, spotty pattern of shrubs in the understory.

Predators of adult northern bobwhite include hawks and eagles (*Accipitridae*), falcons (*Falconidae*), foxes (*Vulpes, Urocyon*), bobcat (*Lynx rufus*), and domestic cats (*Felis sylvestris*) and dogs (*Canis domesticus*). Predators of chicks and eggs include weasels and skunks (*Mustelidae*), raccoons (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), snakes (*Coluber spp.; Elaphe spp.*), crows and ravens (*Corvus spp.*), rats (*Ratus norvegicus*), squirrels and chipmunks (*Sciuridae*) (Klimstra 1975; Murray 1957; Terres 1980). The bobwhite quail is also a popular game bird throughout much of its range with days spent afield by hunters also in decline in recent years.

The recovery of bobwhite quail may be difficult with an accelerating loss of available land to create and maintain quail habitat throughout its range. Restoring bobwhite populations range-wide will depend upon: the amount of agricultural lands that are enhanced to provide nesting, brood rearing, and roosting habitats for quail and other grassland species; the amount of pine dominated and mixed pine hardwood lands that are managed to provide open grass- and forb-dominated ground cover through thinning, harvesting, and periodic burning; and the amount of rangeland that is managed to improve native plant communities and provide quail food and cover.

Since 1966, populations of northern bobwhite in South Carolina appear to have been steadily decreasing (trend estimate –4.42; p=0.0000; Sauer et.al. 2000). Breeding bird surveys on the forest have shown a downward trend that can also be attributed to a lack of early successional habitat and isolated habitat fragments. Several avian species within the same guild as the northern bobwhite quail are also declining. These species include Bachman's sparrow, prairie warbler, loggerhead shrike, whip-poor-will's and other associated resident and neotropical migratory songbirds.

Recent covey counts and covey estimates have been calculated on SCDNR WMA tracts (SCDNR 2001 data) in South Carolina. These tracts have been intensively managed for bobwhite quail and associated species. The data show increased density in birds per acre for those lands that are managed through prescribed burning and other habitat manipulation. Pre-treatment data for a 4,000 acre tract on the Long Cane Ranger District shows that a hunter can expect to find only one covey per 109 acres or 0.01 birds per acre.

<u>Direct and Indirect Effects</u>

Habitat needs for northern bobwhite were considered during development of habitat management provisions included in the draft revised forest plan by reviewing and incorporating elements of the *Northern Bobwhite Conservation Initiative* (Dimmick et.al. 2002), a report by the Southeast Quail Study Group Technical Committee. Habitat provisions that are expected to lead to improved conditions for quail include those for restoration of woodlands, savannas, and grasslands, restoration and maintenance of open pine forests, creation of early successional forests, and maintenance of permanent openings. Differing effects of alternatives on quail habitat are indicated under sections on Woodlands, Savannas, and Grasslands; Pine and Pine-Oak Forests; Mix of Early and Late Successional Forests; and Permanent Openings. In general, alternatives that provide for higher levels of prescribed fire and vegetation management would favor quail habitat and populations. Alternatives with an emphasis on permanent openings (F, E), restoring woodland/savanna conditions ((B, D, E, I), and providing early successional forest conditions (A, D, F, and I) would have the greatest benefit for this species.

The alternatives that include management activities that would create early successional habitat can be expected to favor populations of quail and associated species. Recent studies by the South Carolina Department of Natural Resources on WMA tracts have shown that populations of quail increase with habitat manipulation such as thinning and prescribed burning on a regular basis. Since the lack of suitable habitat (e.g., early successional forest) is believed to be the limiting variable of bobwhite quail, an aggressive attempt to reclaim and maintain suitable habitats on the national forests will result with a continual increase in their population.

Cumulative Effects

Cumulatively, trends in habitat quality and quantity on nearby private lands are likely to continue. With few exceptions, it is not expected that private landowners will restore or manage to maintain significant amounts of high quality quail habitat. The decline of early successional forest and uneven aged stands on public lands and the increase or the accumulating of mature forest landscapes have forced the decline of bobwhite quail. The lack of a structured or strategic timber harvest regime that perpetuates a mosaic of habitats has been detrimental to quail and many other species of wildlife. Among the alternatives considered, Alternative G would provide the least amount of habitat and Alternatives E and F would provide the greatest amounts of habitat for quail.

American Woodcock

Affected Environment

Although classed as a game bird, populations of woodcock have shown large declines in the eastern U.S. since surveys began in 1968 (Krementz and Jackson 1999). In the Southern Appalachians and Piedmont, breeding populations are highly variable in density and spotty in distribution. Wintering population densities vary from year-to-year, but the species is much more common and widely distributed in winter than in summer in the South. According to conservation status rankings, the woodcock is apparently secure in Alabama and Tennessee, and is secure in Virginia and Georgia; its status is unranked in South Carolina (Natureserve 2001). The woodcock is listed as a priority species under the Forest Service's southern national forest migratory and resident landbird conservation strategy (Gaines and Morris 1996).

The American woodcock is closely associated with young second-growth hardwoods and other early-successional habitats that are a result of periodic forest disturbance (Straw et.al. 1994). Ideal habitat consists of young forests and abandoned farmland mixed with forested land (Keppie and Whiting 1994). These include forest openings or clearings for singing displays in spring, shrubby thickets or other young hardwoods on moist soils for feeding and daytime cover, young second-growth hardwoods for nesting, and large fields for night-time roosts (Mendall and Aldous 1943; Andrle and Carroll 1988; Boothe and Parker 2000). European settlement and subsequent clearing presumably favored this species (Foss 1994).

To support woodcock populations, habitat structure appropriate for feeding, display/ roosting, and nesting all must be provided in suitable areas and in adequate configurations. Feeding habitat is much less open than display/roosting habitat and consists predominantly of second-growth (15- to 30-years-old) hardwood or mixed woods with shrubs, but also includes bottomland hardwoods with canopy gaps, upland mixed pine-hardwoods with a herbaceous/grassy understory, and mature longleaf pine after recent burning (Keppie and Whiting 1994). Dense thickets less than 20 years of age are especially important throughout much of the woodcock's range. Typical overstory canopy cover in daytime sites during breeding season is 53-64% (Dunford and Owen 1973). Shrub cover is also typically high (75-87%; Morgenweck 1977) and often adjacent to more open display habitat. Moist, generally loamy soils are important for foraging, because they provide abundant and available earthworms, which is the woodcock's primary food.

Roosting and display habitat is typically open fields or regenerating forests. Maintenance of old fields for roosting and display habitat can be accomplished through disking, mowing, use of herbicides, and prescribed burns, although maintaining some small trees and shrubs is desirable. The goal is to create open habitats that are "patchy," rather than uniform in structure. As the ground and mid-story vegetation disappear through succession, woodcock will cease using the site (Krementz and Jackson 1999).

Silvicultural practices can also enhance habitat (Sepik et.al. 1981; Rosenberg and Hodgman 2000). Clearcuts can provide good nocturnal roosting habitat. Furthermore, clearcutting small strips and blocks in mature woods in Maine has been shown to increase numbers (Dwyer et.al. 1982a); new blocks or strips are cut every 8-10 years on a 40-50-year rotation to provide a continuous supply of young growth. McAuley et.al. (1996) recommend maintaining at least 25% of land in early-successional habitat by clearcutting blocks at least 2 ha, or 30 m-wide strips, in mature forest on a 40-year rotation. Stands dominated by shrub species may be encouraged and maintained by strip-cutting on a 20-year rotation for woodcock (Sepik et.al. 1981). Shelterwood and seed trees left in partial timber harvests help to retain the patchy structure that woodcock prefer. Thinning and selection harvests can also improve dense forests for woodcock by allowing light to reach the ground. Boothe and Parker (2000) recommend burning slash from clearcuts to enhance these openings for woodcock nesting, courting, and roosting. Shifts away from even-aged forest management may be detrimental to populations (Keppie and Whiting 1994; Rosenberg and Hodgman 2000).

Natural disturbances historically responsible for creation of early-successional habitat also improve woodcock habitat. Beavers created extensive habitat, as did fire and possibly windstorms. In general, maintaining integrity of wetter sites such as springs, streams, and creeks is beneficial to these species. Allowing thickets to grow in riparian areas will greatly improve habitat quality for woodcock, (Krementz and Jackson 1999). Grassy areas near water provide prime nesting and display grounds.

Non-breeding or wintering habitat is similar to breeding habitat but typically includes more open conditions such as sedge meadows, beaver pond margins, rice fields, upper reaches of estuaries and occasionally coastal meadows (del Hoyo et.al. 1996). Winter habitats range from bottomland hardwoods to upland pine forests, young pine plantations, and mature pine-hardwood forests, though in some pine habitats the birds tend to focus their activities in lowlands dominated by hardwoods (Roberts 1993). Unlike during breeding, mature pine-hardwood and bottomland hardwoods are often preferred (Krementz and Pendleton 1994; Horton and Causey 1979). During the non-breeding season, woodcock generally occupy moist thickets in daytime, and shift to more open habitats such as pastures, fields (including agricultural), and young clearcuts at night. A diversity of habitat types and age classes may be especially important to survival when severe weather forces woodcock from preferred sites (Krementz and Pendleton 1994). The use of prescribed burns is a common forest management practice and can be used to set back plant succession. A light, controlled fire can maintain habitat patchiness as well. Burns may also remove pine needle cover, opening the ground to woodcock foraging. Mowing can also be used to improve foraging habitat, but appropriate habitat should be maintained for nesting birds (Roberts 1993).

Breeding populations of woodcock are low and poorly distributed in the piedmont and more common in the mountains of South Carolina. Although populations of woodcock fluctuate, both physiographic areas on the Sumter support large numbers of woodcock during migration and over the winter months in suitable habitats. High quality woodcock breeding, stop-over, and wintering habitat is currently limited in supply and distribution on the forest.

Direct and Indirect Effects

Habitat needs for American woodcock were considered during development of habitat management provisions included in the draft revised forest plan. Habitat provisions that are expected to lead to improved conditions for woodcock include those for maintenance of some level of early-successional riparian habitat, creation of early-successional forests in general, and establishment and maintenance of permanent openings. Differing effects of alternatives on woodcock habitat are indicated under sections on Riparian Areas, Successional Forests, and Permanent Openings. In general, alternatives that provide for higher levels of early successional forests (Alternatives A, D, F, I), early succession in riparian areas (B, E, F, I), and those that have an emphasis on permanent openings (E, F) and woodland/savanna habitats (B, I) would favor woodcock habitat and populations.

Cumulative Effects

Extensive harvesting activities on private forestlands in the piedmont provide suitable stopover and wintering habitats, but limited nesting habitat for woodcock. Little activity affecting the abundance or distribution of suitable habitat for woodcock.occurs in the mountains.

Black Bear

Affected Environment

The black bear (Ursus americanus) uses a wide variety of habitats in the Southern Appalachians, occurring primarily on national forests, national parks and large state managed properties of the Southern Blue Ridge, Northern Cumberland, and Allegheny Mountains and the Northern Ridge and Valley. These public lands in Virginia, West Virginia, North Carolina, South Carolina, Tennessee, and Georgia connect to form a forested landscape of over 6 million acres where bears are generally distributed at low to medium densities. The diversity of habitats including older oak forests in this large block of habitat, along with increased protection and conservative hunter harvest, has allowed bear populations throughout the southeastern mountain region to increase six-fold over the past 30 years (Pelton 2001). Average annual bear harvest in South Carolina has increased 10-fold over the same time period (SCDNR data).

South Carolina's mountain black bear population is found in the extreme northwestern counties of the state, which includes the Andrew Pickens Ranger District of the Sumter National Forest. The trend in bear harvest combined with the increase in nuisance bear reports and information from annual bait station surveys over the last ten years indicate the black bear population is increasing in and around the Andrew Pickens Ranger District (SCDNR data). Although there is increased interest in black bears in the piedmont, bears are generally absent to transient in this physiographic area (SAMAB 1995:61, SCDNR).

At one time it was generally accepted that levels of human access within bear habitat determine the degree of negative effects on bears (Beringer 1986; Brody and Pelton 1989), and high bear population densities were associated with areas of low open road density (SAMAB 1995:87). While open roads are still an influence on bear populations, evidence suggests that, in recent years high bear densities and the greatest increases in populations are occurring in landscapes where people live, particularly where some agricultural land uses are present.

The Andrew Pickens Ranger District represents about one-fourth of available bear habitat in the mountains of South Carolina. On the Sumter National Forest, important habitat elements are areas with limited open road access, availability of escape cover, habitat diversity, and availability of hard and soft mast. Black bears are opportunistic omnivores and consume a variety of seasonal plant and animal foods including flowering plants, grasses, various roots and tubers, and especially soft mast (grapes, berries, apples, etc.). The availability of soft mast (fruit and berries) in the spring and summer is the determining factor in bear movements, body weights, and nuisance bear reports prior to mast crops in the fall. Availability of hard mast (acorns and hickory nuts) is critical throughout the winter, and reproductive success is closely related to this habitat factor (Eiler 1981; Wathen 1983; Eiler et.al. 1989). Total production of hard mast and production by individual trees can fluctuate from year-to-year due to climatic and other factors (Downs and McQuilkin 1944; Fowells 1965). Results of South Carolina's annual hard mast survey are displayed in Figure 3-9.

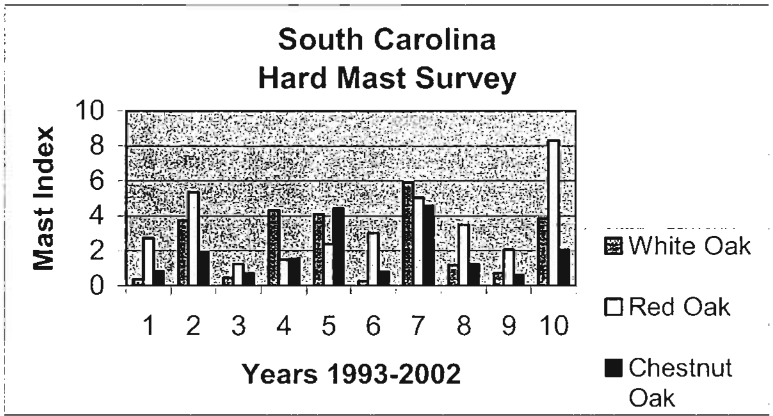

Figure 3-9. Summary of South Carolina's annual hard mast survey.

Under general Southern Appalachian forest conditions, most oaks produce acorns from 40 years of age until death (150 to 200-plus years), although production drops off in later years (USDA Forest Service 1990). Average annual white oak acorn production begins to decline when trees reach about 30 inches dbh (diameter at breast height) (Greenberg 1999; Johnson 1994), and northern red oak acorn production also declines at about 30 inches (Greenberg 1994). Black and scarlet oaks are prolific producers at smaller size classes. Chestnut oak production peaks at about 20 inches dbh and production remains relatively stable after that (Johnson 1994). Acorn production can be sustained over time by ensuring adequate regeneration of oaks, releasing super-canopy highly productive white oaks and providing a wide variety of species and age classes of oaks across the landscape.

Since bears utilize nearly any abundant plant or animal food, they are likely to thrive when a diversity of forest age classes and food sources are available. Vegetation management can provide much of this diversity (Reagan 1990). Naturally occurring disturbances such as ice storms, wildfires, and hurricanes provide habitat diversity, but at random intervals and locations; benefits may be limited and unreliable.

Bears den in a wide variety of sites including road culverts, abandoned buildings, and in vegetation (Carlock et.al. 1983). Traditional dens are found on the ground in caves, rockfalls, or under the root mass of uprooted trees, and in hollow trees. Carlock et. al. (1983) and M. Vaughan (pers. comm.) found that hollow trees are preferred dens. Brody (1984) found that ground dens are preferred in the North Carolina mountains. Preference may be related to availability and may be a learned behavior (Brody 1984).

Hunting demand for black bear in South Carolina is also increasing. The number of bear hunting permits sold remained relatively stable from the early 1980s through 1992. Permit sales in recent years have been steadily increasing, nearly doubling the average permit sales between 1981 and 1992 (491 permits), in 2002 (932 permits).

Direct and Indirect Effects

South Carolina Department of Natural Resources regulation of hunter harvest is the primary influence on bear population levels on the Andrew Pickens Ranger District. However, national forest management determines habitat features such as levels of public access, levels of vegetation diversity, availability of hard and soft mast, and availability of den trees.

Alternatives with a majority of the Andrew Pickens Ranger District assigned to management prescription 8.A1 (Alt. I) will provide substantial improvements for establishing and maintaining quality habitat for black bear. The 8.A1 prescription is designed to provide abundant supplies of hard mast, a perpetual supply of escape cover and soft mast in regeneration areas, and an increase in land area with seasonal or year-round restrictions on motor vehicle access. The combination of these management actions is beneficial for bear. Other alternatives (E, F), and 7E2 and 10B prescriptions (Alternatives A, D, & E) will also provide suitable conditions for bear through the development of early-successional forests. Habitat diversity by alternative is further addressed in the section on Mixed Early and Late Successional Forests. Potential for hard mast production is described in part in sections on Mesic Deciduous Forests and Oak and Oak-Pine Forests.

Availability of potential den trees on the Sumter National Forest is augmented by a forestwide standard requiring their retention during all vegetation management treatments. Potential dens are trees greater than 20 inches dbh that are hollow with broken tops (Carlock et.al. 1983). This standard applies across all alternatives. Dens are addressed under Section 4.3, Snags, Dens, and Downed Wood.

Also related to human access are issues of inappropriate food and trash disposal and occurrence of "nuisance bear" activity (Stiver 1988; Rogers 1976). The Sumter National Forest developed a forestwide objective to provide recreation facilities, recreation services, public information, and enforcement to minimize wildlife access to human food and trash where appropriate. This would minimize bear mortality and injury related to "nuisance" behavior.

Black bear populations are expected to persist and increase in population across the Sumter National Forest through implementation of each of the alternatives.

Cumulative Effects

The current status of South Carolina's mountain black bear population is good (SCDNR 2002). The overall regional forecast is for potential bear habitat to remain stable on public land, including the Sumter National Forest and adjacent Jocassee Gorges area. It is not expected that private landowners will restore or manage to maintain significant amounts of high quality black bear habitat, which will tend to further concentrate black bear populations on public lands. Decreases in black bear populations are expected on private lands due to continued loss of forested habitats and increased development (SAMAB 1995:87).

White-tailed Deer

Affected Environment

White-tailed deer use a variety of forest types and successional stages to meet their year-round needs. In the Southern Appalachians, regeneration areas and older forests provide complementary benefits to deer (Johnson et.al. 1995). Older forests generally are most important in the fall and winter when acorns are the dominant fall and winter food item (Wentworth et.al. 1990a). Deer nutrition, reproduction, weights, and antler characteristics are influenced by the availability of acorns (Harlow et.al. 1975; Feldhammer et.al. 1989; Wentworth et.al. 1990a, 1992). Use of even-aged regeneration areas was very low in winter (Wentworth et.al. 1990b). However in the spring and summer, regeneration areas provide an abundance of food and are heavily utilized (Wentworth et.al.1990b; Ford et.al. 1993). Young regenerating stands contain substantial quantities of woody browse, herbs, fungi, and soft mast, all of which are limited in older forests (Johnson et.al. 1995). Food plots, especially those containing clover-grass mixtures, are used most intensively in early spring. They also are an important source of nutritious forage in winter, especially when acorns are in short supply (Wentworth et.al. 1990b).

In eastern hardwood forests, Barber (1984) recommended that at least 50% of the acreage should consist of mature mast trees with the remainder containing an interspersion of evergreens, shrubs and vines, and openings with herbaceous and young-growth woody vegetation. Based on utilization data, current deer densities in the Southern Appalachians can be maintained by providing approximately 5% in regenerating stands (Wentworth et.al. 1990b). Wentworth et.al. (1989) concluded that approximately 2% of the area in high quality wildlife openings would be necessary to adequately buffer the effects of a poor acorn year.

Acorns also are important for deer in the piedmont (Harlow and Hooper 1971). However, because of the availability of alternative high quality foods, especially Japanese honeysuckle and agricultural crops, deer are less mast dependant than in the mountains. Prescribed burning, thinning, and regulated timber harvest all can be used to improve habitat conditions for deer. Whittington (1984) described a management system where pine forests are managed on an 80-year rotation with an 8-year cutting cycle. Each entry, 85% of the area is thinned, 10% is regenerated and 5% is retained in wildlife openings. Approximately 20% is maintained in oak dominated hardwood stands of mast producing age.

White-tailed deer are present throughout the Southern Appalachian Assessment area and the piedmont. Population densities generally are medium to high in the Northern Ridge and Valley, Allegheny Mountains, Northern Cumberland Mountains, and Southern Appalachian Piedmont sections (SAMAB 1996: 50-60). High population densities are associated with greater amounts of dispersion of forests and cropland and lesser amounts of coniferous forestland managed on short rotations. Deer densities greatly increased over the last half-century in South Carolina due to extensive restoration efforts. As a result, deer are established in all counties in the state at population levels that support hunting. Current deer densities generally are higher on private land, national forests, and state properties where habitat management is occurring than on other surrounding ownerships.

The white-tailed deer is economically and ecologically the most important wildlife species in the South (Miller 1996). In South Carolina the white-tailed deer is the most popular as well as the most economically important game animal (Ruth 2001). Game harvest regulations and habitat improvement techniques – such as forest thinnings, prescribed burning, and wildlife opening development – have helped create healthy deer populations throughout the state.

Deer population densities in South Carolina are higher in the piedmont than in the mountains. In 1996 the deer population was estimated to be between 15 and 30 deer per square mile in the counties that include the Andrew Pickens Ranger District (Miller 1996). The deer density was estimated to be greater than 30 deer per square mile in the piedmont counties that include the Enoree and Long Cane Districts. Overall the deer populations on the national forest are believed to be increasing because in 2000, the deer populations were estimated in some areas to be from 15 to 45 deer per square mile in the piedmont, and 15 to 30 deer per square mile in Oconee County (includes the Andrew Pickens District) (Ruth 2001). There are three state wildlife management areas (WMAs) that encompass the Sumter NF. During the 2001 deer hunting seasons 308,828 deer were harvested which included the highest statewide doe harvest to date (Ruth). An estimated 42,000 of the 149,993 licensed South Carolina deer hunters possessed WMA permits (Ruth). Ruth further estimated 6,723 of those possessing WMA permits hunted 109,936 days and harvested 13,593 deer. The longest deer season in the Nation combined with liberal bag limits appears to have stabilized the growth of the herd at an annual harvest level of approximately 300,000 animals (Ruth 2001).

The demand for and use of WMAs on the national forests for deer hunting has been increasing in recent years. Total land area in WMAs statewide is declining and the Francis Marion and Sumter National Forests now provide over 60% of the public hunting land in the state. The result is more hunters are spending more days afield in pursuit of deer on national forests in South Carolina. This trend is expected to continue with increased competition for leased hunting rights on private lands in South Carolina.

Direct and Indirect Effects

As discussed above, white-tailed deer require a mixture of forest/successional stage habitats to meet their year-round habitat needs. Key requirements include the interspersion of mature mast-producing stands during the fall and winter, early successional habitats to provide browse and soft mast, and permanent openings. The effects of each of the alternatives on these key habitat features are discussed in detail in previous sections.

Even though South Carolina has been in drought conditions from 1996 to 2002, hard and soft mast production on the Sumter National Forest appears to be relatively consistent (SCDNR data). In the last 10 years there has been a drastic decline in timber harvest on the Sumter National Forest. The decrease in timber harvest has resulted in an accumulation of immature to mature forest stands. Deer will persist and possibly thrive within these forest conditions, but they will move or expand their home ranges when their essential requirements (i.e., food, cover, and water) are not readily available (Garner 2001). Dense stands and closed canopies reduce browse and fruit yields (Yarrow and Yarrow 1999). Deer density maintenance, production, and health could be improved if thinnings or uneven-aged timber harvesting practices (primarily group selection) were implemented. Yarrow recommends a targeted basal area of 50 to 60 square feet per acre to open the overstory and encourage the production of desirable understory vegetation when managing a southern forest for deer. Tactical timber harvesting practices will furnish deer with essential varieties of browse and cover (McCabe and McCabe 1984; Kammermeyer and Thackston 1995; Palik and Engstorm 1999). The result of timber harvesting due to recent southern pine beetle outbreaks has slightly improved diversity of forest stands and provided temporary forest openings needed by many species of wildlife, including deer.

Through proper habitat manipulation with timber management and liberal deer harvest regulations, the Sumter National Forest is able to support existing-to-slightly denser populations of deer. If deer populations are not available to hunters however, or if forests are mismanaged, habitat damage, increases in vehicle accidents, and property damage (e.g., row crops, gardens, ornamental plants) could be expected as deer thrive and move to new sources of food throughout the year.

Cumulative Effects

Deer prefer habitat diversity. Pure stands of unmanaged pine generally provide poor deer habitat because of the low abundance and quality of understory forage and the scarcity of mast-producing hardwoods (Yarrow and Yarrow 1999). Recent management activities on the Sumter National Forest due to southern pine beetle outbreaks have helped create small pockets of suitable and diverse habitats. However, private lands adjacent to the Sumter National Forest likely have more suitable deer habitat and overall better food sources (with the possible exception of hard mast), particularly where agricultural land uses are present. Alternatives with low levels of vegetation management compared to surrounding land uses (B & G) would tend to increase crop damage from deer on adjacent lands. Alternatives A, D, E, F, & I would improve forage conditions on the forest and tend to reduce crop damage on adjacent lands.

Eastern Wild Turkey

Affected Environment

Wild turkey occupy a wide range of habitats, with a diversity of habitats providing optimum conditions (Schroeder 1985). This includes mature mast-producing stands during fall and winter, shrub-dominated stands for nesting, and herb-dominated communities, including agricultural clearings for brood-rearing. The variety of habitats used by wild turkeys for roosting, brood-rearing, nesting, feeding, and escape vividly demonstrates the need for a rich mosaic of habitats to provide for wild turkeys alone, much less the many other species of valuable wildlife (Yarrow and Yarrow 1999). Habitat conditions for wild turkey can be enhanced by management activities such as prescribed burning and thinning (Hurst 1978; Pack et.al. 1988), and the development of herbaceous openings (Nenno and Lindzey 1979; Healy and Nenno 1983).

For the eastern hardwood region, Wunz and Pack (1992) recommended maintaining 50 to 75% of the area in mast producing condition and approximately 10% in widely distributed permanent herbaceous openings in addition to the temporary openings that result from timber harvest and other activities. They suggest that regeneration area should be 30 acres in size or less. Light thinnings (<20% of BA) are recommended to enhance the herbaceous component of stands. Heavier thinnings, which may increase the quantity of woody species in the absence of prescribed burning, are less desirable. Prescribed burning in conjunction with thinning in oak forests can be used to enhance brood habitat. Other important habitat components include spring seeps, especially in areas with regular snow cover, and an abundant supply of a diversity of soft mast producing plants (e.g., dogwood, black gum, grape, blueberry, etc). Quality turkey habitat will support one bird per 20 to 30 acres or one flock to about 640 acres (Yarrow and Yarrow 1999).

For the southern pine region, Hurst and Dickson (1992) recommended that at least 15% of the area should be kept in mature hardwoods such as streamside zones or pine-hardwood corridors. Low density vegetation found in fallow fields, power line rights-of-way and forest openings; and provision of soft mast species also are important habitat components. Pine plantations should be thinned frequently and burned on a 3-to-5 year rotation to enhance herbaceous vegetation and soft mast production.

Eastern wild turkeys are present throughout the Southern Appalachian Assessment area. Population densities generally are medium to high in the Northern Ridge and Valley, Allegheny Mountains, Northern Cumberland Mountains, and Southern Appalachian Piedmont sections, and low to medium in the remainder of the SAA area (SAMAB 1996: 60-61). Within its range the wild turkey population has increased by more than 1 million birds between 1985 and 1990 (Long 1988). In 1991, there were about 4 million turkeys, 1 million more than existed 5 years earlier (Keck and Langston 1992). High population densities are associated with greater amounts of oak forest and cropland, and lesser amounts of developed and coniferous forestland. Current turkey densities appear to be on a gradual decline on public lands in the mountains. One of the factors contributing to the slow decline of turkey in the Andrew Pickens Ranger District is the lack of early successional habitats not associated with a maintained road, or private agricultural land uses. Turkey populations in the piedmont however appear to be on a steady increase across the forest.

The number of turkey hunting permits issued in South Carolina has increased 10-fold statewide since 1973. Turkey harvest has also increased dramatically from 536 birds reported in 1973 to 16,348 harvested in 2002 (SCDNR data). Both the direct and indirect economic benefits of hunting wild turkey have annually exceeded $500 million (Baumann et.al. 1989).

Direct and Indirect Effects

As discussed above, wild turkey require a mixture of forest/successional stage habitats to meet their year-round habitat needs. Key requirements include the interspersion of mature mast producing stands during fall and winter, shrub dominated stands for nesting, and herb dominated communities, including permanent openings for brood-rearing. Disturbance also may be a concern during the nesting season. The effects of each of the alternatives on these key habitat features are discussed in detail in previous sections (Mesic Deciduous Forest, Oak and Oak-Pine Forest, Mix of Early and Late Successional Forests). In general, alternatives that have high levels of thinning and burning (B, E, & I), active thinning, harvest or restoration strategies (A, B, D, E, F, I), increasing abundance of oak across the forest (A, D, I), an emphasis on permanent openings (F, E), and woodland savanna habitats (A, D, I) would be beneficial to turkey.

Cumulative Effects

Increased urbanization and declines in agricultural land uses in and around the Sumter National Forest are reducing habitat quality and limiting expansion of turkey populations in the piedmont and the mountains. Less forest area in early successional stages and poorly distributed forest openings is also limiting the potential of turkey populations on the forest, especially in the mountains.

Ruffed Grouse

Affected Environment

On the Sumter National Forest, the ruffed grouse range is limited to the Andrew Pickens Ranger District.

Ruffed grouse utilize a variety of forest habitats and successional stages. Nesting cover generally is located in pole timber or larger hardwood stands (Harris 1981, Thompson and Dessecker 1997). Haney (1996) also reported use of old-growth cove hardwood forests in the Southern Appalachians for nesting and brood rearing. While nesting habitat does not appear to be limiting, close interspersion with secure adult cover and brood habitat is important (Thompson and Dessecker 1997).

Key features of brood cover are security and an abundant high protein food source. Insects are most abundant in habitats characterized by lush herbaceous vegetation (Dimmick et.al. 1996). Thompson and Dessecker (1997) describe brood cover as 3-7 year-old regenerating stands containing significant herbaceous component and shrub-dominated old fields and herbaceous openings. In Georgia, broods preferred upland hardwood sapling (>10 year-old) and pole timber habitats, but also used sawtimber stands, although not in proportion to availability (Harris 1981). Regeneration areas (<6 years-old) and evergreen shrub thickets were avoided. Brood habitats were characterized by dense and diverse herbaceous vegetation that provided low overhead cover with freedom of movement beneath. Dimmick et. al. (1996) suggest that the lack of interspersion of areas with a well developed herb layer and areas of high stem density for protective cover may be one of the limiting factors in southeastern grouse populations. They suggest that brood habitat could be enhanced by the conversion of logging roads and log landings to linear food plots by planting clover/grass mixtures, which will provide bugging areas in close proximity to secure cover.

Adult cover, including drumming habitat usually consists of young regenerating forest (6-15 years-old) or shrub cover (Thompson and Dessecker 1997). The dense cover provides protection from both avian and mammalian predators. Secure cover is provided in habitats with good vertical structure (8,000+ stems/acre) of 15-20 foot saplings (Kubisiak 1989). Dimmick et. al. (1996) reported that males began to orient their drumming sites around or in clearcuts within 3 years post harvest. In Georgia, drumming habitat was associated with the presence of a relatively dense understory of heath shrubs, primarily flame azalea and mountain laurel (Hale et.al. 1982). No strong preference for timber types or stand condition classes was evident. Harris (1981) found that males preferred upland hardwood sawtimber, generally associated with evergreen shrub thickets during the breeding and post-breeding seasons.

Dimmick et. al. (1996) found that breeding male density (based on drumming counts) increased significantly in response to clearcutting in Tennessee. A similar response to timber harvest was reported from oak-dominated forests in Missouri (Wiggers et.al. 1992). Highest grouse densities occurred where 7-to-15 year-old hardwood regeneration comprised greater than 14% of the area.

In oak forests of the Central Hardwood region, Thompson and Dessecker (1997) recommended managing on an 80-year rotation, which would maintain approximately 15% of the forest in brood or adult cover (3-15 years old). Appropriate regeneration methods include clearcut, seedtree, and shelterwood methods. Residual basal areas should not exceed 20 ft^2/acre. Cutting units should be > 5 acres, and preferably 10-40 acres in size. Group selection is not recommended since the regeneration patches are too small to provide large enough patches of contiguous habitat. In Missouri, Kurzejeski et. al. (1987) also recommended managing oaks on an 80-year rotation, but suggested harvest units should be less than 20 acres in size. In another study in Missouri oak forests, Wiggers et. al. (1992) recommended maintaining more than 14% in 7- to15-year-old hardwood regeneration. Kubisiak (1985) recommended the use of shelterwood cuts or clearcuts of 20 acres or less, leaving designated groups or scattered oaks (residual basal area less than 20 ft^2) with potential as mast-bearers or den trees. Larger cuts up to 40 acres are acceptable if in linear strips.

Dominant fall and winter foods in the Southern Appalachians include leaves and fruits of greenbrier (*Smilax spp.*), the leaves of mountain laurel (*Kalmia latifolia*), fruits of grapes (*Vitis spp.*) and oaks (*Quercus spp.*), and Christmas fern (*Polystichum acrostichoides*) (Seehorn et.al. 1981). Similarly, Stafford and Dimmick (1978) reported that greenbrier, mountain laurel, and Christmas fern were the dominant fall and winter food items in the Southern Appalachian region of Tennessee and North Carolina. When available, acorns comprise a significant proportion of the diet (Seehorn et.al. 1981; Servello and Kirkpatrick 1987; Kirkpatrick 1989; Thompson and Dessecker 1997). They provide a high-energy food source during the critical winter period when forage quality is limited (Servello and Kirkpatrick 1987; Kirkpatrick 1989). However, lack of secure cover in open oak stands may limit their use by grouse (Stafford 1989, Thompson and Dessecker 1997). Kubisiak (1985) suggested that 40-60% of a compartment be maintained in stands of mast-bearing age.

Ruffed grouse are found primarily in the Northern Ridge and Valley, Allegheny Mountains, Northern Cumberland Mountains, Blue Ridge Mountains, Northern Cumberland Plateau, and Southern Cumberland Mountains (SAMAB 1996:66-67). Low density populations also extend into the adjacent portions of the Central Ridge and Valley, Southern Cumberland Plateau, Southern Ridge and Valley, and Southern Appalachian Piedmont. Population densities generally are moderate in the Blue Ridge Mountains and low to moderate elsewhere. Current grouse densities generally are higher on national forest lands, national parks, and the Cherokee Indian Reservation than on other ownerships. Grouse population densities have declined over the last 25 years. The declining trend likely is largely due to the reduction of forest cover in the sapling-pole successional class, which is important to this species.

The Andrew Pickens Ranger District is the southern edge of ruffed grouse range in eastern North America. Ruffed grouse populations are historically low on the district, but equally persistent. Currently, there is a considerable lack of preferred habitats on the Andrew Pickens District largely due to the lack of harvesting, thinning and prescribed burning over the last 20 years. Recent interest in burning woodland habitats in the mountains combined with southern pine beetle outbreaks (1995-96 and 2001–02) have created some opportunities for improving grouse habitat in some locations.

Direct and Indirect Effects

Although ruffed grouse use a variety of forest habitats and successional stages, population responses are most strongly tied to the availability of early successional forests, particularly hardwood shrub-seedling habitat. Alternatives with a majority of the Andrew Pickens Ranger District assigned to management prescription 8.A1 (Alt. I) would provide substantial improvements for establishing and maintaining quality habitat for ruffed grouse. Many of the other prescriptions (7E2, 10B) will provide suitable to optimal conditions for grouse through the development of early-successional forests in alternatives A, D, & E. More early successional forest discussion is found in the section on Mix of Early and Late Successional Forests.

Cumulative Effects

Little opportunity for ruffed grouse management exits in the mountains on lands in other than public ownership. Private land holdings are relatively small in acreage, quite often owned by absentee landowners, and harbor several summer retreat type developments or commercial endeavors (orchards, rafting, etc.). A survey of land uses in a representative area of the Andrew Pickens District identified less than 3% of private lands in preferred habitats for ruffed grouse (i.e., early successional forests). With few exceptions, it is not expected that private landowners will restore or manage to maintain significant amounts of high quality ruffed grouse habitat, which will tend to further concentrate grouse populations on public lands.

Migratory Birds

Affected Environment

Migratory birds have become a focus of conservation concern due to evidence of declining population trends for many species. To ensure that forest plan revision alternatives include provisions for migratory bird habitat, planning efforts included coordination with the Migratory Bird Office of the U.S. Fish and Wildlife Service and others under the umbrella of Partners in Flight (PIF). PIF is a cooperative effort involving partnerships among federal, state, and local government agencies, foundations, professional organizations, conservation groups, industry, the academic community and private individuals. It was launched in response to growing concerns about declines in populations of land bird species and to emphasize conservation of birds not covered by existing conservation initiatives.

PIF has developed Bird Conservation Plans for each physiographic area relevant to the national forest planning area. These plans are science-based, long-term, proactive strategies for bird conservation across all land ownerships and are designed to ensure long-term maintenance of healthy populations of native land birds. Forest Service biologists worked with PIF regional and local coordinators to identify key management issues and opportunities for high priority species on national forest lands, and developed related goals, objectives, and standards for incorporation into the draft revised forest plan. In addition, *The Southern National Forest's Migratory and Resident Landbird Conservation Strategy* (Gaines and Morris 1996) was also reviewed and incorporated into planning efforts. This strategy identifies priority species and provides a framework for monitoring populations. The monitoring program described in this document is currently being implemented, and would continue under all alternatives.

Because migratory and resident land birds are so ubiquitous and diverse, they are relevant to the majority of ecological communities and habitat elements considered during forest planning. As a result, provisions for these species are integrated into numerous plan objectives and standards focused on achieving desired habitat conditions. Effects of these provisions on ecological communities and associated species are addressed throughout the EIS. Effects to specific species of birds are addressed under appropriate sections for those chosen as management indicator species. In addition, all relevant conservation priority species, as identified by the U.S. Fish and Wildlife Service, are assessed under the terrestrial species viability evaluation.

The Andrew Pickens District of the Sumter National Forest falls completely within the Southern Blue Ridge physiographic area, and is covered by the PIF Bird Conservation Plan for the Southern Blue Ridge. Despite habitat protection on federal lands within the Southern Blue Ridge physiographic area, 30% of breeding species have declined sharply in the last 30 years, and an additional 18% have shown possible declines (Hunter et. al. 1999). Major issues identified in the plan for the Blue Ridge, as well as key land bird conservation issues that apply to the Andrew Pickens District are summarized below.

PIF Southern Blue Ridge Plan

Major Issues:

- Creating structural diversity in high elevation hardwoods.
- North slope old-growth restoration.
- Mature hemlock forest protection.
- Reduction of off-site white pine
- Creating structural diversity in mature mixed mesophytic forests.
- Restoration of native mountain pines.
- Maintenance of oak forests (regeneration, late successional forests, thin and burn mid successional stages).

Key Conservation issues:

1. Large patches of mature hemlock-white pine, northern hardwoods and mixed mesophytic (mesic hardwood) forests are uncommon due to past land management and elevation influences. Older stands of northern hardwood and mixed mesophytic hardwood forests cover about 24% of the Andrew Pickens Ranger District. With the exception of the Chattooga River Corridor, low elevation forests, especially riparian forests, are fragmented on private lands. Carolina hemlock forests are treated as rare communities in the Sumter National Forest plan; they will be maintained and restored across all alternatives. Forests dominated by eastern hemlock will not be subject to regeneration harvest. Hemlock will be retained as patches during all silvicultural treatments.

2. Many early successional species at mid- to high elevations have declined due to forest maturation, fire suppression, elimination of grazing, and decline in active forest management on federal lands. The Sumter National Forest has established objectives for early successional forest, permanent openings, and woodland/savanna habitats.

3. A predominance of forest stands in the 40-100 year age class on national forest lands has resulted in a closed canopy condition with poorly developed understory and sub-canopy. There is an overall lack of forest with "old growth" characteristics, including a multi-layered canopy, snags and downed woody debris. The Sumter National Forest established objectives for canopy gap creation to enhance the understory in uplands (see Mesic Deciduous Forests), and riparian habitats.

4. Development of private land to resort, urban and suburban uses is negatively affecting the ability to manage forest habitats at a landscape level.

The Enoree and Long Cane Districts of the Sumter National Forest fall completely within the Piedmont physiographic area, and are covered by the PIF Bird Conservation Plan for the Piedmont. Land use changes prior to national forest ownership drastically changed the vegetative landscape of the area. Farming practices associated with raising cotton, tobacco, and row crops triggered a considerable loss of soil in the clay hills of the piedmont. Remnants of shortleaf/bluestem, longleaf pine, and other fire adapted plant communities can still be found throughout this physiographic area. Major issues identified in the plan for the piedmont, as well as key land bird conservation issues that apply to the Enoree and Long Cane Districts are summarized below.

PIF Piedmont Plan

Major Issues:

- Mix of mature riparian forest and patches of dense understory.
- Forest interior versus early successional habitat—emphasize early-successional habitat in pine forests.
- Native grassland/savanna/woodland restoration; shortleaf pine restoration.
- Wetland restoration.

Key Conservation Issues:

1. Intensification of agricultural and forest management practices has reduced open woodland, savanna and grasslands, as well as early successional habitats throughout the piedmont. Features such as hedgerows, field borders, and brushy abandoned fields have declined in numbers and size. Private forestlands, which occupy a vast majority of the piedmont, have been gradually converted to fast growing, dense stands of loblolly pine managed on relatively short rotations. The Sumter National Forest has established objectives for early successional forest; restoration of woodland savanna habitats; and, increases in mixed pine/hardwood stands on piedmont districts.

2. Urbanization is increasing in the piedmont of South Carolina. Once lands are converted to other uses, they are no longer available as habitats for a majority of forest wildlife species. Increases in urban development also negatively impact the ability to manage existing forested lands along the urban interface.

3. Restoration and consolidation of habitats in the piedmont requires cooperative efforts among the many public and private landowners in the area. Early successional habitats, riparian habitats, and forest interior habitats are the highest priority for management for migrating or breeding birds in the piedmont. Of particular interest is the recreation and restoration of water bird habitats in the piedmont for summer foraging, spring and fall migration, and wintering habitat for a wide variety of bird species.

In addition to providing a diversity of habitats for migratory birds on the landscape, collision of migratory birds with communications towers was also considered during plan revision. The U.S. Fish and Wildlife Service (2000) has identified this as an issue needing attention:

> "Construction of these towers (including radio, television, cellular, and microwave) increases at an estimated 6 to 8 percent annually in the United States. According to the Federal Communication Commission's *2000 Antenna Structure Registry*, the number of lighted towers greater than 199 feet above ground level (AGL) currently number over 45,000 and the total number of towers over 74,000. Non-compliance with the registry program is estimated at 24 to 38 percent, bringing the total to 92,000 to 102,000. By 2003, all television stations must be digital, adding potentially 1,000 new towers exceeding 1,000 feet AGL."...."The construction of new towers creates a potentially significant impact on migratory birds, especially some 350 species of night-migrating birds. Communications towers are estimated to kill 4-5 million birds per year."

Two mechanisms of bird mortality occur at communications towers (World Wide Web 2002). The first occurs when birds flying in poor visibility conditions do not see the structure (i.e., blind collision). Towers that are lighted at night for aviation safety may help reduce blind collisions, but they bring about a second mechanism for mortality. When there is a low cloud ceiling or foggy conditions, refracted light creates an illuminated area around the tower. Migrating birds lose their stellar cues for nocturnal migration and a broad orienting perspective on the landscape in these weather conditions. The lighted area may be the strongest cue for navigation, and birds remain in the lighted space by the tower. Mortality occurs when they collide with the structure and guy wires, or even other migrating birds, as more and more passing birds occupy the relatively small, lighted space. The lights apparently do not attract birds from afar, but hold birds that pass within the vicinity.

Because migratory birds cover such large areas, their conservation is dependent on the distribution of suitable habitats across large regions. Currently, national forests provide some of the largest blocks of forested habitat when viewed at a physiographic area scale. As habitat quality and quantity continues to change on many privately-owned lands due to conversion to urban and suburban land uses, national forest lands will become even more important to migratory birds in the future. Efforts by the Forest Service to coordinate closely with partners in bird conservation and to incorporate proactive conservation measures into forest plan revisions are designed to ensure national forests continue to support at-risk migratory birds.

Direct, Indirect and Cumulative Effects

The key to providing habitat for migrating species is a landscape where suitable habitats dominate.

For waterfowl, wading birds and colonial nesting birds that means substantial areas of mud flats, shallow water and some deep-water habitats along migration corridors (Broad

River and Savanna River systems on the Sumter). Increases in these habitats would also benefit dispersal of some listed species such as wood stork and bald eagle. Alternatives B, E, F and I place an emphasis on creating and restoring wetlands and "water bird" habitats. All alternatives recognize beaver ponds as important elements in providing wetland and associated habitats. The potential for summer foraging habitat for wood stork in the piedmont is expected to be high in Alternatives B, F, and I, and greatest in Alternative E. Likewise the potential for providing high quality wintering and stop-over habitat for migrating water birds is high in Alternatives B, F, and I and greatest in Alternative F.

For migratory songbirds, a mosaic of habitats in a landscape with connections to similar habitats is essential to replenish fat reserves for neotropical migrants passing through the forest, important to reproductive success for summer breeding populations, and crucial to over-wintering species in achieving good reproductive condition prior to migration. Habitats with high amounts of persistent hard seed from herbaceous plants, grains and some grasses (on the ground or still on the stem), fall fruits (dogwood, grape, black cherry), early spring bud and seed producers such as elm and maple, and woody plants with persistent fruit (sycamore, black gum, grape) are important to this group. Alternatives with an emphasis on a diversity of forested habitats, including woodland/savanna development and providing canopy gaps would be more capable of providing and sustaining adequate habitats for migratory songbirds. Alternatives F, B, E, and I have the greatest opportunities to provide quality habitats for these and associated species, including raptors.

For migratory game birds (mourning dove and woodcock), the presence of grasslands, shrubland, agriculture, and early successional forests are essential. Bare ground and an abundance of small seeds for doves, and grassy areas with shrubs and an abundance of earthworms for woodcock are the determining factors if they are present or not. Both species migrate in large numbers through the forest in the spring and fall, and both species are resident summer breeders. Woodcock are generally low in numbers and poorly distributed across the forest during the breeding season. Doves are much more common on the forest and nesting habitat (cedars, scattered pines, open woodland/savanna conditions) in close proximity to food sources is a valuable habitat characteristic. Several permanent wildlife openings are managed cooperatively with the SCDNR specifically for doves. (Woodcock are discussed in more detail in the section Demand Species.) Alternatives with an emphasis on permanent openings (F, E), restoring woodland/savanna conditions ((B, D, E, I), and providing early successional forest conditions (A, D, F, and I) would have the greatest benefit for these species.

Species Viability

Terrestrial Species Viability Evaluation

Affected Environment

National Forest Management Act (NFMA) regulations, adopted in 1982, require that habitat be managed to support viable populations of native and desirable non-native vertebrates within the planning area (36 CFR 219.19). USDA regulation 9500-004, adopted in 1983, reinforces the NFMA viability regulation by requiring that habitats on national forests be managed to support viable populations of native and desired non-native plants, fish, and wildlife. These regulations focus on the role of habitat management in providing for species viability. Supporting viable populations involves providing habitat in amounts and distributions that can support interacting populations at levels that result in continued existence of the species well-distributed over time.

The Southern Appalachian region supports extremely high levels of biological diversity relative to other regions, viewed both nationally and globally. As a result, large numbers of species are present for which population viability may be of concern. Detailed demographic or habitat capability analysis to evaluate population viability is not feasible for this large number of species. Therefore, our goal for this evaluation is to use a clearly defined, transparent process to identify species for which there are substantive risks to maintenance of viable populations, and to ensure consideration of appropriate habitat management strategies to reduce those risks to acceptable levels where feasible.

For comprehensiveness and consistency, evaluation of species viability was coordinated across several national forests undergoing simultaneous plan revisions. These forests are the Jefferson National Forest, Cherokee National Forest, Sumter National Forest, Chattahoochee and Oconee National Forests, and National Forests in Alabama. These forests encompass portions of the Southern Appalachian, Piedmont, and East Gulf Coastal Plain ecoregions. However, the scale for this assessment is set by NFMA regulations as the "planning area," or the area of the National Forest System covered by a single forest plan. Therefore, separate risk assessment was done for each national forest covered by a separate forest plan. Risk assessment was further split where national forest units under the same forest plan occur in different ecoregions, or are widely separated geographically. The Sumter National Forest includes into piedmont (Enoree and Long Cane districts) and Southern Blue Ridge (Andrew Pickens district). Although viability evaluation was coordinated across the ecoregions, analysis presented here focuses on information relevant to the Sumter National Forest.

Because NFMA regulations require providing habitat for species viability within the planning area, focus of this evaluation is on habitat provided on national forest land. Surrounding private lands may contribute to, or hinder, maintenance of species viability on national forest land, but are not relied upon to meet regulation requirements. For this reason, habitat abundance was assessed based on conditions found on national forest land. Habitat distribution, however, was assessed considering the condition of intermixed ownerships and conditions, which may affect the interactions of species among suitable habitat patches on national forest land.

Evaluation of migratory birds focused on breeding populations only, unless otherwise indicated. This focus does not mean that wintering and migrating populations were not considered during planning, but that viability evaluation makes most sense when viewed in terms of the relative stability of breeding populations.

NatureServe, under a Participating Agreement with the Forest Service, compiled much of the foundational information used in this evaluation. NatureServe is an international non-profit organization, formerly part of The Nature Conservancy. Its mission is to develop, manage, and distribute authoritative information critical to conservation of the world's biological diversity. Partnership with NatureServe was sought as a means to ensure the best available information on species status and habitat relationships was used in this evaluation. Under this agreement, NatureServe staff engaged numerous species experts and state heritage programs to develop a relational database that includes relevant information on species' status, habitat relationships, and threats to viability.

Viability Evaluation Process

Risk to maintenance of viability over the next 50 years was assessed for each species in relation to each of its principle habitat relationships by plan revision alternative. Risk assessment was based on three factors: 1) current species abundance, 2) expected habitat abundance in 50 years, and 3) expected habitat distribution in 50 years (Figure 1). Once risk ratings were developed, we assessed how well management strategies across alternatives provide for species viability.

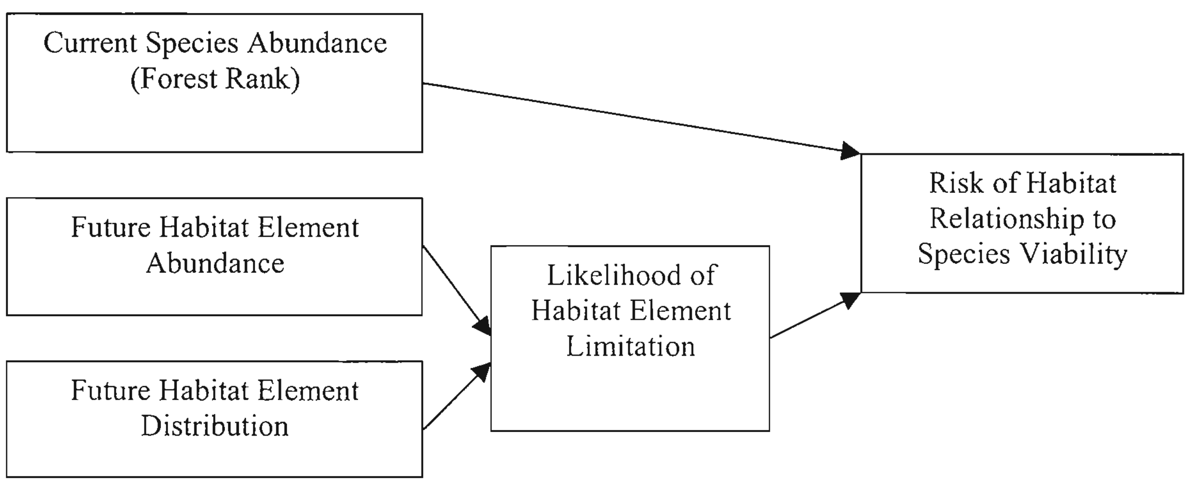

Figure 3-9. Relationship of variables used to rate the risk to viability resulting from a species' relationship with a habitat element.

A comprehensive list of species with potential viability concern was compiled for the Sumter National Forest. The list includes those species found, or potentially found, on the National Forest from the following categories:

- Species listed as proposed, threatened, or endangered under the federal Endangered Species Act,
- Species listed on the Regional Forester's Sensitive Species list,
- Species identified as locally rare on the National Forest by Forest Service biologists, including state threatened and endangered species,
- Birds of conservation concern as identified by the US Fish and Wildlife Service, and
- Declining species of high public interest.

Species lists from all national forests in the Southern Appalachian and Piedmont Eco-regions in South Carolina, were pooled to create comprehensive lists of species of potential viability concern. NatureServe staff and contractors assigned abundance ranks for each species on the comprehensive eco-region list for the piedmont districts and the Andrew Pickens district of the Sumter National Forest. These Forest Ranks, or F Ranks, follow the conventions used by NatureServe and others in defining State and Global Ranks (Table 3-56).

F Ranks were used in viability risk assessment as a categorical variable representing a species' current abundance. Forest Service biologists reviewed F Ranks developed by NatureServe to identify any inconsistencies between these rankings and Forest Service information. Discrepancies in this abundance variable were resolved through coordination with NatureServe and its contractors. Where conflicting information or opinion on species abundance occurs, the most conservative information (i.e., that indicating lowest abundance) was used.

Only those species that are both confirmed present and rare or of unknown abundance (F1 through F3, and F?) on the Sumter National Forest were assessed for viability risk. Species ranked as F? were treated as F1 species to provide a conservative approach to those species for which abundance information is not available. Species that are currently abundant on the forest (F4, F5) are assumed to be at low risk of losing viability within the next 50 years, and, therefore, were not further evaluated for viability risk.

Table 3-56. Forest Ranks (F Ranks) and definitions used to define status of species on piedmont and Andrew Pickens districts of the Sumter National Forest as part of species viability evaluation for forest plan revision, 2002.

F Rank	F Rank Definition
F0	Not present; no known occurrences on the forest unit, and forest is outside species' range or habitat not present.
F1	Extremely rare on the forest unit, generally with 1-5 occurrences.
F2	Very rare on the forest unit, generally with 6-20 occurrences.
F3	Rare and uncommon on the forest unit, from 21-100 occurrences.
F4	Widespread, abundant, and apparently secure on the forest unit.
F5	Demonstrably secure on the forest unit.
F?	Present on the forest, but abundance information is insufficient to develop rank.
FP	Possibly could occur on the forest unit, but documented occurrences are not known.
FH	Of documented historical occurrence on the forest unit; may be rediscovered.
FX	Once occurred but has been extirpated from the forest unit; not likely to be rediscovered.

Because viability regulations focus on the role of habitat management in providing for species viability, habitat condition was the primary factor used to drive species viability evaluation. NatureServe staff and contractors identified habitat relationships for all species of potential viability concern, linking each species to vegetation community types, successional stages, and habitat attributes as appropriate. Based on this information, each species was linked by Forest Service biologists to one or more habitat elements. These habitat elements (Table 3-57) roughly correspond to categories of management direction included in the draft revised plan, and to sections of effects analysis included in this environmental impact statement. NatureServe staff reviewed and provided adjustments to species' assignment to these habitat element groups.

Table 3-57. Habitat elements used to plan for, and assess risk to, viability of terrestrial species during forest plan revision, Sumter National Forest.

Habitat Element	Element Description
Bogs, Fens, Seeps, Seasonal Ponds	Bogs, fens, seeps, seasonal ponds characterized by saturated soils
Open Wetlands	Open wetlands, marshes, beaver ponds, generally characterized by having some permanent standing water
River Channels	Riverine gravel and sand bars, and river banks subject to flood scour
Glades and Barrens	Glades and barrens characterized by shallow soils, exposed parent material, and sparse or stunted vegetation
Table Mountain Pine Forests	Forests and woodlands dominated by table mountain pine and maintained by periodic fire

Basic Mesic Forests	Basic mesic or "rich cove" forests characterized by calciphilic herbs and usually dominated by maples, basswood, and buckeye.
Rock Outcrops and Cliffs	Rock outcrops and cliffs characterized by exposed rock, shallow soils and sparse vegetation
Spray Cliffs	Rock that remains wet for all or most of the year, associated with waterfalls or seepage
Canebrakes	Canebrakes characterized by dense stands of cane and open canopies, usually within riparian areas
Caves and Mines	Caves and mines with microclimates capable of supporting associated biota
Mature Mesic Hardwood Forests	Mid- and late-successional mesic deciduous forests, including northern hardwood, mixed mesophytic, mesic oak, and bottomland hardwood forests
Mature Hemlock Forests	Mid- and late-successional eastern hemlock and eastern hemlock-white pine forests in native settings, typically on stream terraces and other mesic sites
Mature Oak Forests	Dry to mesic mid- and late-successional oak and oak-pine forests subject to moderate levels of disturbance sufficient to maintain the oak component
Mature Yellow Pine Forests	Mid- and late-successional southern yellow pine and pine-oak forests maintained in open conditions by frequent fire
Early-Successional Forests	Early-successional forests, typically aged 0-10 years and dominated by woody species
Mature Forest Interiors	Mature forest interiors with minimal adverse effects due to forest edge.
Canopy Gaps	Mid- and late-successional mesic deciduous forests with a diverse vertical and horizontal structure as a result of gaps in the canopy
Woodlands and Savannas	Open woodlands and savannas characterized by low canopy cover and rich grass-dominated understories, and maintained in open conditions by periodic fire
Grasslands	Grasslands with little to no overstory, usually occurring as patches within woodland and savanna complexes and maintained by periodic fire
Mixed Landscapes	Landscapes characterized by a broad mix of successional habitats
Late Successional Riparian	Riparian areas dominated by mid- and late-successional deciduous forests
Early-Successional Riparian	Riparian areas with a dense understory or early-successional forest in riparian areas
Snags	Forests containing an abundance of snags

Downed Wood	Forests containing an abundance of downed wood and thick leaf litter
Den Trees	Forests containing an abundance of large hollow trees suitable as den trees
Hard Mast	Forests producing abundant hard mast
Remoteness	Remote habitats away from frequent human disturbance
Lakeshores	Forested shores of lakes and ponds
Water Quality	High water quality in streams and lakes

Effects to these habitat elements are analyzed in this EIS under other sections. Based on these analyses, each habitat element was assigned categorical values by alternative to indicate future abundance (Table 3-58) and distribution (Table 3-59), general likelihood that the habitat element would limit viability of associated species (Table 3-60), and overall effect of national forest management on the habitat element (Table 3-61).

The future abundance variable (Table 3-58) is defined as the abundance of the associated habitat element in fifty years if the alternative were selected and implemented over that fifty-year period. This variable indicates the abundance of the habitat element on national forest land only, to provide focus on the role of the national forest planning area in supporting associated species. Its focus on national forest land only reflects recognition that viability is to be provided within the "planning area" (area covered by the forest plan). Definitions of abundance categories are stated in quantifiable terms in order to be objective as possible; however, in many cases quantifiable estimates of future abundance are not available. In these cases, knowledge of Forest Service biologists was used to assign abundance values based on current conditions and the magnitude and direction of effects expected under each alternative.

Table 3-58. Values used to categorize projected abundance of each habitat element after 50 years of implementing each forest plan revision alternative.

Habitat Abundance Value	Description
Rare	The habitat element is rare, with generally less than 100 occurrences, or patches of the element generally covering less than 1 percent of the national forest planning area.
Occasional	The habitat element is encountered occasionally, and generally is found on 1 to 10 percent of the national forest planning area.
Common	The habitat element is abundant and frequently encountered, and generally is found on more than 10 percent of the national forest planning area.

Similar to the future abundance variable, the future distribution variable (Table 3-59) is defined as the distribution of the associated habitat element in fifty years if the alternative were selected and implemented over that fifty-year period. In contrast to the abundance variable, it includes consideration of intermixed ownership patterns and conditions, and their general effects on movements and interactions of individuals among the suitable habitat patches found on national forest land. Because assessing adequacy of habitat distribution for a species requires a level of knowledge not available for most species, and the number of species being evaluated is very large, we have defined habitat distribution in terms of a historical reference condition—that which was present prior to the major perturbations associated with European settlement of the planning area. This period is generally defined as 1000 to 1700 A.D. This approach relies on the assumption that a habitat distribution similar to that which supported associated species during recent evolutionary history will likely contribute to their maintenance in the future, and that the further a habitat departs from that historical distribution, the greater the risk to viability of associated species. This approach has its own set of difficulties, as evidence of presettlement conditions relevant to the planning area is often anecdotal and scarce. In addition, the reference period may have included a wide variety of conditions as a result of growing aboriginal populations and accompanying use of agriculture and fire during the early portion of this period, and their subsequent dramatic decline due to disease epidemics following early European contact. Nevertheless, the precision required to assign the categorical values for this variable is not high, and may be supported by general positions described in mainstream conservation literature (see Wear and Greis 2002). Knowledge of Forest Service biologists was used to assign distribution values, based on interpretations of historical conditions supported by conservation literature, current conditions, and magnitude and direction of effects expected under each alternative.

Differences in scale between the Habitat Abundance and Habitat Distribution variables is intentional in order to bring two different pieces of information into the analysis. Habitat Abundance has been defined in terms of the amount of habitat on national forest land only. This definition reflects the amount of habitat available to support a species on the national forest, in recognition of regulation requirements that viability be provided within the "planning area" (area covered by the forest plan). Habitat Distribution, on the other hand, is defined to include the landscape setting of national forest lands, which includes the intermingled private lands and broken ownership patterns that provides the context for national forest populations and may affect ability of individuals living on national forest lands to interact with each other.

Table 3-59. Values used to categorize projected distribution of each habitat element after 50 years of implementing each forest plan revision alternative.

Habitat Distribution Value	Description
Poor	The habitat element is poorly distributed within the planning area and intermixed lands relative to conditions present prior to European settlement. Number and size of habitat patches and/or their evenness in distribution across the landscape is greatly reduced.
Fair	The habitat element is fairly well distributed within the planning area and intermixed lands relative to conditions present prior to European settlement. Number and size of habitat patches and/or their evenness in distribution across the landscape is somewhat reduced.
Good	The habitat element is well distributed within the planning area and intermixed lands relative to conditions present prior to European settlement. Number and size of habitat patches and/or their evenness in distribution across the landscape is similar to or only slightly reduced relative to reference conditions.

Habitat element abundance and distribution variables were combined to create one variable to indicate the general likelihood that the habitat element would be limiting to populations of associated species (Table 3-60). In this general context, habitat limitation refers to a habitat factor—quantity, distribution, or quality—that results in risk to continued existence of the species within the planning area. Everything else being equal, quality habitat elements that are rare and poorly distributed are those most likely to cause risk to viability of associated species; those that are common and well distributed are least likely to cause risk to viability of associated species.

Table 3-60. Likelihood of habitat limitation (High, Moderate, and Low) to associated species as derived from habitat abundance and distribution values.

Habitat Abundance	Habitat Distribution		
	Poor	Fair	Good
Rare	High	High	Moderate
Occasional	High	Moderate	Low
Common	Moderate	Low	Low

Providing for species viability requires providing abundant and well-distributed habitat in ways that allow existing populations to persist or expand. The ability of existing populations to respond to available habitat depends in part on their current robustness, which is generally a function of population size. In general, for a given habitat condition, small populations will be at more risk than large populations. To reflect this fact, likelihood of habitat limitation variable was combined with a species' F Rank for each species/habitat element interaction to generate viability risk ratings (Table 3-61). Associations of very rare species with habitat elements that are likely to be most limiting were identified as those most at risk; associations of more common species with habitats less likely to be limiting received lower risk ratings. Ratings include three levels of "high" risk (Table 3-61) to ensure that results err on the side of caution.

Table 3-61. Viability risk ratings for species/habitat interactions as a function of a species' F Rank and likelihood of habitat element limitation variables.

Likelihood of Habitat Element Limitation	Species F Rank		
	F1 or F?	F2	F3
High	Very High	High	Moderately -High
Moderate	High	Moderately-High	Moderate
Low	Moderately-High	Moderate	Low

Once viability risk ratings were developed for each species/habitat relationship, habitat elements most commonly associated with risks to species viability were identified by counting the number of very high, high, and moderately high ratings associated with each. To assess the role of national forest management in minimizing viability risk associated with each habitat element, a management effects variable was assigned to each habitat element by alternative. The management effects variable (Table 3-62) categorizes the goal of management for the habitat element, the expected resulting trend, and any additional opportunity for minimizing viability risk. Numbers of very high, high, and moderately-high risk ratings were summarized by management effects variable by alternative to assess how well alternatives address viability-related habitat needs.

Table 3-62. Values used to categorize the effect of national forest management in minimizing or contributing to species viability risk associated with each habitat element by forest plan revision alternative.

Management Effect Value	Description
1	Abundance and distribution of the habitat element is maintained or improved by providing optimal protection, maintenance, and restoration to all occurrences (with limited exceptions in some cases). Little additional opportunity exists to decrease risk to viability of associated species because management is at or near optimal.
2	Abundance and distribution of the habitat element is improved through purposeful restoration, either through active management or passively by providing for successional progression. Opportunity for decreasing risk to associated species is primarily through increasing rates of restoration, where possible.
3	The habitat element is maintained at approximately current distribution and abundance, though location of elements may shift over time as a result of management action or inaction. Opportunity to reduce risk to viability of associated species is primarily through adopting and implementing objectives to increase abundance and distribution of the habitat element.
4	Regardless of management efforts, the habitat element is expected to decrease in distribution and abundance as a result of factors substantially outside of Forest Service control (e.g., invasive pests, acid deposition). Opportunity to reduce risk to viability of associated species is primarily through cooperative ventures with other agencies and organizations.
5	The habitat element is expected to decrease in distribution and abundance as a result of management action or inaction. Opportunity to reduce risk to viability of associated species is primarily through adopting and implementing objectives to maintain or increase this habitat element.

Distribution of viability risk was also summarized by species status, i.e., federally listed under the Endangered Species Act, listed as Regional Forester's sensitive species, or identified as locally rare or of other concern. The species status summary highlights the relative role of other provisions included in law and policy that result in additional consideration of at-risk species during planning.

Direct, Indirect and Cumulative Effects (Viability Evaluation Results)

Species viability evaluation for the Sumter National Forest included consideration of 151 species of the Southern Appalachian ecoregion and 39 species of the Piedmont ecoregion. Of these species, 21 species from the Southern Appalachian ecoregion and 13 species from the Piedmont ecoregion are either federally list or Regional Forester Sensitive Species known to occur on the Sumter National Forest.

Outcomes for habitat elements, as described under individual effects analysis sections, are summarized in Appendix F, Table F-1, using the four variables described in Table F-1

Key to Variables. These variables indicate expected habitat condition following fifty years of implementing each forest plan revision alternative.

Ratings of risk to viability for each species/habitat relationship by alternative are presented in Appendix F, Table F-2. To facilitate comparison of effects of alternatives on species viability, the number of very-high, high, and moderately-high risk ratings are summarized for each alternative by habitat element (Table 3-63 and 3-64), management effect (Tables 3-65 and 3-66), and species status (Table 3-67 and 3-68).

Viability risk rating summaries indicate relatively small differences among alternatives relative to effects on species viability. This similarity results from planning efforts to include in all alternatives provisions to provide for species viability in compliance with NFMA regulations. Examples of such provisions common to all alternatives (except Alternative F, which represents the current forest plan) are the prescriptions for rare communities and riparian corridors. Similarity of viability outcomes among alternatives also results from the influence of external forest health threats, which represent serious risks to forest communities and associated species regardless of alternative. Differences among alternatives are also muted by the small scale of actions contemplated under all alternatives relative the more extensive effects to ecological systems that have occurred to national forest landscapes since European settlement. Broader scale effects will likely continue to have similar important effects to species viability regardless of which alternative is selected.

Evaluation results indicate, under all alternatives, high levels of risk to species viability are associated with certain key habitats (Table 3-63- and 3-64). Highest risks are associated with 1) bogs, fens, seeps, and seasonal ponds, 2) mature mesic hardwood forests, 3) rock outcrops and cliffs, 4) woodlands, savannas, and grasslands on the Andrew Pickens, 5) Late successional riparian. Highest levels of risk are associated with 1). Mature mesic hardwood forests, 2) Basic mesic forests, 3) Mature oak forests, woodlands, and savannas, and 4) Late successional riparian on the piedmont districts.

Bogs, fens, seeps, and seasonal ponds are critical to maintaining species viability due to their natural rarity on the landscape, their decline during European settlement due to beaver control and drainage for agriculture, and the number of rare species associated with them. Provisions for the rare community prescription provide for optimal protection and management of all occurrences of these habitats under all alternatives except Alternative F; therefore, opportunities for further reducing risk to viability associated species are limited. Under Alternative F such habitats would likely be maintained, but would not receive the focused attention provided by the rare community prescription.

Mature mesic hardwood forests and late successional riparian forests are fairly common on the Andrew Pickens, but many are even-aged having established themselves following extensive clearing during the late 19th and early 20th centuries. High quality mature mesic forests are rare, due to the decline of American chestnut, and the low structural diversity typical of even-aged stands. On the piedmont, high quality mature mesic and basic mesic hardwood forests are relatively uncommon due to past land use and conversion to pine.

Many mature mesic and late successional riparian forests lack the hard mast (oak) component they had prior to European settlement.

On the Andrew Pickens, the many locally rare species associated with waterfall spray zones are included in with the rock outcrop and cliff rare community. These species are typically vulnerable due to recreational use in these areas and competition with non-native invasive plants. On both the Andrew Pickens and piedmont districts, the woodlands, savannas, and grasslands are much reduced compared to presettlement (Cecil Frost, personal comment), due to lack of frequent prescribed fire.

Table 3-63. Number of species/habitat relationships rated as of very high, high, and moderately high risk to terrestrial species viability for each habitat element by forest plan revision alternative, Andrew Pickens Ranger District of the Sumter National Forest.

	Alternative						
Habitat Element/Risk	A	B	D	E	F	G	I
Bogs, Fens, Seeps, Seasonal Ponds							
Very High	20	20	20	20	20	20	20
High	6	6	6	6	6	6	6
Moderately High	3	3	3	3	3	3	3
Total	29	29	29	29	29	29	29
Open Wetlands							
Very High	3	3	3	3	3	3	3
High	2	2	2	2	2	2	2
Moderately High	1	1	1	1	1	1	1
Total	6	6	6	6	6	6	6
River Channels							
Very High	1	1	1	1	1	1	1
High	0	0	0	0	0	0	0
Moderately High	3	3	3	3	3	3	3
Total	4	4	4	4	4	4	4
Glades and Barrens							
Very High	3	3	3	3	3	3	3
High	3	3	3	3	3	3	3
Moderately High	3	3	3	3	3	3	3
Total	9	9	9	9	9	9	9
Table Mountain Pine Forests							
Very High	2	2	2	2	2	2	2
High	1	1	1	1	1	1	1
Moderately High	0	0	0	0	0	0	0
Total	3	3	3	3	3	3	3
Basic Mesic Forests							
Very High	8	8	8	8	8	8	8
High	5	5	5	5	5	5	5
Moderately High	2	2	2	2	2	2	2
Total	15	15	15	15	15	15	15

Rock Outcrops and Cliffs							
Very High	0	0	0	0	0	0	0
High	17	17	17	17	17	17	17
Moderately High	5	5	5	5	5	5	5
Total	22	22	22	22	22	22	22
Spray Cliffs							
Very High	0	0	0	0	0	0	0
High	4	4	4	4	4	4	4
Moderately High	2	2	2	2	2	2	2
Total	6	6	6	6	6	6	6
Canebrakes							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Caves and Mines							
Very High	0	0	0	0	0	0	0
High	4	4	4	4	4	4	4
Moderately High	0	0	0	0	0	0	0
Total	4	4	4	4	4	4	4
Mature Mesic Hardwood Forests							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	25	25	25	25	25	25	25
Total	25	25	25	25	25	25	25
Mature Hemlock Forests							
Very High	7	7	7	7	7	7	7
High	2	2	2	2	2	2	2
Moderately High	0	0	0	0	0	0	0
Total	9	9	9	9	9	9	9
Mature Oak Forests							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	6	6	6	6	6	6	6
Total	6	6	6	6	6	6	6
Mature Yellow Pine Forests							
Very High	0	0	0	0	0	0	0
High	2	2	2	2	2	2	2
Moderately High	2	2	2	2	2	2	2
Total	4	4	4	4	4	4	4
Early-Successional Forests							
Very High	0	0	0	0	0	1	0
High	0	0	0	1	0	2	0
Moderately High	1	1	1	2	1	1	1
Total	1	1	1	3	1	4	1
Mature Forest Interiors							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0

Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Canopy Gaps							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	2	2	2	2	2	2	2
Total	2	2	2	2	2	2	2
Woodlands, Savannas, and Grasslands							
Very High	0	0	0	0	9	0	0
High	9	9	9	9	12	9	9
Moderately High	12	12	12	12	5	12	12
Total	21	21	21	21	26	21	21
Mixed Landscapes							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	2	2	2	2	2	2	2
Total	2	2	2	2	2	2	2
Late Successional Riparian							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	19	19	19	19	19	19	19
Total	19	19	19	19	19	19	19
Early-Successional Riparian							
Very High	0	1	0	1	1	1	0
High	1	0	1	0	0	0	1
Moderately High	0	2	0	2	2	2	0
Total	1	3	1	3	3	3	1
Snags							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	2	2	2	2	2	2	2
Total	2	2	2	2	2	2	2
Downed Wood							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	4	4	4	4	4	4	4
Total	4	4	4	4	4	4	4
Den Trees							
Very High	0	0	0	0	0	0	0
High	2	2	2	2	2	2	2
Moderately High	0	0	0	0	0	0	0
Total	2	2	2	2	2	2	2
Hard Mast							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Remoteness							

Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Lakeshores							
Very High	0	0	0	0	0	0	0
High	1	1	1	1	1	1	1
Moderately High	0	0	0	0	0	0	0
Total	1	1	1	1	1	1	1
Water Quality							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	1	1	1	1	1	1	1
Total	1	1	1	1	1	1	1
All Habitats							
Very High	44	45	44	45	54	46	44
High	59	58	59	59	61	60	59
Moderately High	95	97	95	98	90	97	95
Total	198	200	198	202	205	203	198

Table 3-64. Number of species/habitat relationships rated as of very high, high, and moderately high risk to terrestrial species viability for each habitat element by forest plan revision alternative, Piedmont Districts of the Sumter National Forest.

	Alternative						
Habitat Element/Risk	A	B	D	E	F	G	I
Bogs, Fens, Seeps, Seasonal Ponds							
Very High	1	1	1	1	1	1	1
High	1	1	1	1	1	1	1
Moderately High	1	1	1	1	1	1	1
Total	3	3	3	3	3	3	3
Open Wetlands							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	2	2	2	2	2	2	2
Total	2	2	2	2	2	2	2
River Channels							
Very High	2	2	2	2	2	2	2
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	2	2	2	2	2	2	2
Glades and Barrens							
Very High	2	2	2	2	2	2	2
High	0	0	0	0	0	0	0
Moderately High	1	1	1	1	1	1	1
Total	3	3	3	3	3	3	3
Basic Mesic Forests							
Very High	0	0	0	0	6	0	0
High	6	6	6	6	1	6	6
Moderately High	1	1	1	1	0	1	1
Total	7	7	7	7	7	7	7
Rock Outcrops and Cliffs							
Very High	0	0	0	0	0	0	0
High	1	1	1	1	1	1	1
Moderately High	0	0	0	0	0	0	0
Total	1	1	1	1	1	1	1
Canebrakes							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Mature Mesic Hardwood Forests							
Very High	0	0	0	0	0	0	0
High	5	5	5	5	5	5	5
Moderately High	3	3	3	3	3	3	3
Total	8	8	8	8	8	8	8
Mature Oak Forests							
Very High	0	0	0	0	0	0	0
High	3	3	3	3	3	3	3

Moderately High	3	3	3	3	3	3	3
Total	6	6	6	6	6	6	6
Mature Yellow Pine Forests							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	2	2	2	2	2	2	2
Total	2	2	2	2	2	2	2
Early-Successional Forests							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Mature Forest Interiors							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Canopy Gaps							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	2	2	2	2	2	2	2
Total	2	2	2	2	2	2	2
Woodlands, Savannas, and Grasslands							
Very High	0	0	0	0	3	0	0
High	3	3	3	3	1	3	3
Moderately High	1	1	1	1	4	1	1
Total	4	4	4	4	8	4	4
Mixed Landscapes							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Late Successional Riparian							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	5	5	5	5	5	5	5
Total	5	5	5	5	5	5	5
Early-Successional Riparian							
Very High	0	0	0	0	0	0	0
High	0	1	0	1	1	1	0
Moderately High	1	1	1	1	1	1	1
Total	1	2	1	2	2	2	1
Snags							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	1	1	1	1	1	1	1
Total	1	1	1	1	1	1	1
Downed Wood							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0

Moderately High	1	1	1	1	1	1	1
Total	1	1	1	1	1	1	1
Den Trees							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Hard Mast							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Remoteness							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Lakeshores							
Very High	0	0	0	0	0	0	0
High	1	1	1	1	1	1	1
Moderately High	0	0	0	0	0	0	0
Total	1	1	1	1	1	1	1
Water Quality							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	1	1	1	1	1	1	1
Total	1	1	1	1	1	1	1
All Habitat Elements							
Very High	5	5	5	5	14	5	5
High	20	21	20	21	14	21	20
Moderately High	25	25	25	25	27	25	25
Total	50	51	50	51	55	51	50

All alternatives, with the exception of Alternative F, are expected to provide for the optimal protection and management of all habitat occurrences and to improve habitat abundance and distribution through restoration (Table 3-65 and Table 3-66). Alternative F will provide for species viability primarily through habitat maintenance, resulting in slightly more species/habitat relationships rated as very high, high, or moderately high risk to terrestrial species viability.

Only Alternative D would reduce habitat elements with high risk species relationships as a direct result of management. These associations involve mature mesic deciduous forests (both Andrew Pickens and piedmont) and mature oak forests (piedmont only), and the structural diversity of canopy gaps found in older age classes of these forests. All other alternatives are expected to maintain or increase levels of these habitat elements.

Table 3-65. Number of species/habitat relationships rated as of very high, high, and moderately high risk to terrestrial species viability for each category of management effect by forest plan revision alternative, Andrew Pickens Ranger District, Sumter National Forest.

	Alternative						
Management Effect/Risk	A	B	D	E	F	G	I
Provide Optimal Protection and Management for All Habitat Occurrences							
Very High	35	35	35	35	0	35	35
High	42	42	42	42	5	42	42
Moderately High	20	20	20	20	1	20	20
Total	96	96	96	96	6	96	96
Improve Habitat Abundance and Distribution Through Restoration							
Very High	2	3	2	3	1	3	2
High	15	14	15	14	4	14	15
Moderately High	48	56	23	55	38	55	48
Total	65	73	40	72	43	72	65
Maintain Habitat Abundance and Distribution							
Very High	0	0	0	0	44	0	0
High	0	0	0	0	49	0	0
Moderately High	27	21	21	21	51	21	27
Total	27	21	21	21	143	21	27
Reduce Habitat Abundance and Distribution as Result of External Factors							
Very High	7	7	7	7	7	7	7
High	2	2	2	2	2	2	2
Moderately High	0	0	0	0	0	0	0
Total	9	9	9	9	9	9	9
Decline in Habitat Abundance and Distribution as Result of Management							
Very High	0	0	0	0	2	1	0
High	0	0	0	1	1	2	0
Moderately High	0	0	31	2	0	1	0
Total	0	0	31	3	3	4	0
Total for All Management Effect Categories							
Very High	44	45	44	45	54	46	44
High	59	58	59	59	61	60	59
Moderately High	95	97	95	98	90	97	95
Total	198	200	198	202	205	203	198

Table 3-66. Number of species/habitat relationships rated as of very high, high, and moderately high risk to terrestrial species viability for each category of management effect by forest plan revision alternative, Piedmont Districts of the Sumter National Forest.

	Alternative						
Management Effect/Risk	A	B	D	E	F	G	I
Provide Optimal Protection and Management for All Habitat Occurrences							
Very High	5	5	5	5		5	5
High	9	9	9	9	1	9	9
Moderately High	6	6	6	6	1	6	6
Total	20	20	20	20	2	20	20
Improve Habitat Abundance and Distribution Through Restoration							
Very High	0	0	0	0	0	0	0
High	6	12	3	11	1	8	8
Moderately High	5	19	4	16	7	10	14
Total	11	31	7	27	8	18	22
Maintain Habitat Abundance and Distribution							
Very High	0	0	0	0	14	0	0
High	5	0	3	0	12	3	3
Moderately High	14	0	8	2	19	8	5
Total	19	0	11	2	45	11	8
Reduce Habitat Abundance and Distribution as Result of External Factors							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Decline in Habitat Abundance and Distribution as Result of Management							
Very High	0	0	0	0	0	0	0
High	0	0	5	1	0	1	0
Moderately High	0	0	7	1	0	1	0
Total	0	0	12	2	0	2	0
Total for All Management Effect Categories							
Very High	5	5	5	5	14	5	5
High	20	21	20	21	14	21	20
Moderately High	25	25	25	25	27	25	25
Total	50	51	50	51	55	51	50

Planning for, and evaluation of, species viability for forest plan revision has focused primarily on providing desired abundance and distribution of habitat elements, in compliance with NFMA regulations. Risks to species viability can be much reduced by additional provisions present in existing law and policy. These include specific consideration of effects to federally listed threatened and endangered species, those proposed for such listing, and Regional Forester's Sensitive Species, in biological assessments and evaluations conducted as part of all national forest management decisions. These assessments and evaluations identify where additional protective measures are warranted to provide for continued existence of the species on national forest land. Projects that may affect federally listed or proposed species must be coordinated with the US Fish and Wildlife Service. In support of these requirements, these species are also often the focus of inventory and monitoring efforts. Additional species-based provisions included in all forest plan revision alternatives supplement existing law and policy. All alternatives include general and species-specific provisions for federally listed species, developed through coordinated planning with the US Fish and Wildlife Service. Many of the high risk species will be conserved through rare community and riparian prescription requirements included in this Forest Plan, as well as through forestwide objectives related to forest health and community restoration.

Table 3-67. Number of species/habitat relationships rated as of very high, high, and moderately high risk To terrestrial species viability for each category of species status by forest plan revision alternative, Andrew Pickens Ranger District of the Sumter National Forest.

	Alternative						
Species Status/Viability Risk	A	B	D	E	F	G	I
Federally Listed or Proposed as Threatened or Endangered							
Very High	1	1	1	1	1	1	1
High	0	0	0	0	0	0	0
Moderately High	2	2	2	2	3	2	2
Total	3	3	3	3	4	3	3
Regional Forester's Sensitive Species							
Very High	2	2	2	2	3	2	2
High	16	16	16	16	17	17	16
Moderately High	21	21	21	22	20	21	21
Total	39	39	39	40	40	40	39
Locally Rare and Other Species							
Very High	41	42	41	42	50	43	41
High	43	42	43	43	44	43	43
Moderately High	72	74	72	74	67	74	72
Total	156	158	156	159	161	160	156
Total for All Species Status Categories							
Very High	44	45	44	45	54	46	44
High	59	58	59	59	61	60	59
Moderately High	95	97	95	98	90	97	95
Total	198	200	198	202	205	203	198

Table 3-68. Number of species/habitat relationships rated as of very high, high, and moderately high risk to terrestrial species viability for each category of species status by forest plan revision alternative, Piedmont Districts of the Sumter National Forest.

	Alternative						
Species Status/Viability Risk	A	B	D	E	F	G	I
Federally Listed or Proposed as Threatened or Endangered							
Very High	0	0	0	0	1	0	0
High	2	2	2	2	1	2	2
Moderately High	2	2	2	2	2	2	2
Total	4	4	4	4	4	4	4
Regional Forester's Sensitive Species							
Very High	0	0	0	0	2	0	0
High	5	5	5	5	3	5	5
Moderately High	5	5	5	5	7	5	5
Total	10	10	10	10	12	10	10
Locally Rare and Other Species							
Very High	5	5	5	5	11	5	5
High	13	14	13	14	10	14	13
Moderately High	18	18	18	18	18	18	18
Total	36	37	36	37	39	37	36
Total for All Species Status Categories							
Very High	5	5	5	5	14	5	5
High	20	21	20	21	14	21	20
Moderately High	25	25	25	25	27	25	25
Total	50	51	50	51	55	51	50

In conclusion, differences in effects to viability risk among alternatives are relatively small. High- risk species/habitat relationships are primarily a result of historical influences that have reduced distribution and abundance of some habitat elements and species populations, and of future impacts from forest health threats. In general, effects of proposed management strategies are small relative to historical impacts and future external threats. In general, risks to species viability are minimized by forest plan revision alternatives that provide a balanced mix of low-disturbance and disturbance-dependent habitat elements. Some elements in this mix are best provided through passive management and protection, while others require active management for restoration and maintenance.

Slight differences in results presented here from those in the FEIS are primarily the result of updates to species' status information (F Ranks) made during the comment period through review and coordination with NatureServe and their contractors. Additional changes are the result of adding species inadvertently omitted from the FEIS and, in some cases, adjustments to habitat condition variables based on further analysis and interdisciplinary review. These adjustments have not resulted in substantial changes to overall patterns of risk, or conclusions relative to overall effects of alternatives. It is important to note that information on the status and ecology of this great diversity of species is constantly changing and will continue to do so as the revised forest plan is implemented. Lists of species of viability concern and related information will be maintained and updated as part of plan implementation; however, this updating will typically be small and incremental, and is not expected to change the overall conclusions of this analysis during this planning period.

Aquatic Viability

Affected Environment

Background

Section 219.19 of the NFMA requires that aquatic (fish) habitat be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area. For planning purposes, a viable population is one that has numbers and distribution of reproductive individuals to insure its continued existence and is well distributed in the planning area.

Aquatic habitats are unique in that they are found in and adjacent to streams and lakes. The mobility of aquatic species is usually limited to these habitats. Habitat alteration is probably the major cause of decline of aquatic diversity in the South. Channelization, impoundment, sedimentation, and flow alterations are the most common physical habitat alterations associated with the decline of aquatic species (Walsh et.al. 1995; Etnier 1997; Burkhead et.al. 1997). Other human-induced impacts to aquatic species include pollution, introduced species, and over-harvesting (Miller 1989).

Habitat quality within a freshwater ecosystem is determined by activities within the watershed (Abell et.al. 2000; Scott and Helfman 2002). Therefore, activities in these habitats, or waterbodies, can be described by similar areas of drainage to estimate the amount of suitable habitat. For administrative purposes these watersheds are described 5th level hydrologic units. The planning areas for aquatic species are 5th level hydrologic units or watersheds at the forest plan level.

It is estimated that over 500 aquatic species are found in the 250 watersheds associated with forests in plan revision. It is impossible determine viability for each of these individual species. As a surrogate, the viability of proposed, endangered, threatened and sensitive (PETS) aquatic species are assessed and threat to their viability determined. Other species with wide ranges are generally not at risk.

To determine if there is adequate habitat for these species, the condition of individual watersheds needs to be determined. Watershed condition is determined from the physical and anthropogenic interactions within the watershed. Ideally, watershed condition would be determined from stream surveys. However, the extent and detail required to address all watersheds, including private land, with stream surveys is not available. To address habitat condition at the watershed level it is necessary to determine values from geographic data. These values are compared among the watersheds and a condition or set of conditions is determined.

Methods and Assumptions

Watershed Condition

Hydrologic units or watersheds are defined as areas that drain to a common point. Fifth level watersheds are generally between 40,000 and 250,000 acres. Once these units are digitally determined then they are queried against other geographic information layers. These layers include ownership, streams, roads, point sources, dams, and landuse from the 1970's and 1990's.

These layers were intersected with the 5th level watersheds and determined as a percent of the watershed or as a density (miles per square mile). Table 3-69 shows what layers, their unit, source, and how they are used.

Table 3-69. Layers, use, source, and unit

Layers		Use	Source	Unit
watersheds		planning unit	from NRCS or USFS	5th level HU
ownership		to determine the potential to affect of Forest Service ownership on viability of Species of Concern	from individual forests	percent
streams		used to determine riparian areas	RF3 data from EPA Basins III	not applicable
roads		road density and riparian road density	from tiger census data	miles per square mile
landuse		determine watershed and riparian area landuse	1970 GIRAS data from EPA Basins III, 1994 NLCD from EPA Region 4	percent
dams		determine altered flow	from EPA Basins III	number per square mile
point sources		cerlis, ricris, and npdes sites	from EPA Basins III	number per square mile

This process is modified from the East-wide Assessment Protocol for Forest Plan Amendment, Revision, and Implementation (USDA Forest Service 2000). Instead of a simplified ranking of 1 through n the individual condition factors were valued or graded (one to five) based on natural breaks using the Jenk's optimization formula within ArcView 3.2a. The values for each layer were averaged to calculate a condition score for each metric where 1 –1.5 = impaired, 1.51 – 2.5 = slightly impaired, 2.51 – 3.50 = average, 3.51 – 4.5 = above average, 4.51 – 5 = excellent. This allows for a determination of condition among the watersheds. However, it does not suggest that a watershed with a score of 4 is twice as good as a watershed of 2, only that the watershed with a value of 4 is above average and the watershed with a value of 2 is below average or slightly impaired. A Watershed Health Index (WHI) was developed to characterize the condition (excellent, average, and below average) of 5th level watersheds with respect to current sediment load increases and to determine a range of Forest Service objectives Appendix G).

The combinations of data used determine the metrics that are outlined in the following list:

1) Sedimentation (road density, road density in the riparian, forest cover (1970's and 1990's), and strip mines (average of 1970's and 1990's).
2) Point Source Pollutants (density of point sources).
3) Temperature (road density in the riparian area, and percent forest (1970's and 1990's) in the riparian area).
4) Altered stream flow (density of dams, road density in the riparian, and average density of strip-mines (1970's and 1990's).

Stressors

Each Forest identified the presence of PETS-LR species for each 5th level watershed across the planning area. These databases were combined into a single database and stressors assigned.

Four stressors were identified: sedimentation, point-source pollution, alterations in water temperature, and altered stream flows. Sensitivity to these stressors was assigned for each species, based on the published literature and personal communications (Terwilliger 1991; Etnier and Starnes 1993; Byron Freeman, Wendell Haag, Melvin Warren, Bernard Kuhajda, Stephen Hiner, and Arnold Eversole personal communications). Species sensitivity to the four stressors was compared with the condition of their respective watersheds to determine the threats to their persistence in the planning area. Threats to aquatic species viability are not limited to these four variables; however, GIS coverages are not available for channelization, introduced species, and over-harvest. For forest level planning it is assumed is that these four stressors adequately describe land disturbance activities in the planning area.

Combination of Watershed Condition and Stressors

To identify watersheds at risk the combined values for each of the watershed condition metrics (sediment, point sources, temperature and altered flows) were multiplied against the presence (value of 1) of species of concern with corresponding stressors (Appendix A4). Watershed condition metrics with a score ≥ 2.51 (average or above for point sources, temperature and altered flows) and a WHI of excellent (for sediment) are assumed to have sufficient aquatic habitat at the watershed scale to maintain species viability.

Direct, Indirect and Cumulative Effects

Aquatic Viability Outcomes

Species of concern were related to the four environmental factors assessed in watershed analysis (point sources, water temperature, flow, and sediment). Separate viability outcomes were determined for each watershed where a species occurrs, because in many cases watersheds support separate populations, and because factors affecting viability can vary considerably from watershed to watershed. Viability outcomes for each species by watershed were determined by incorporating elements of species distribution, abundance, and sensitivities to environmental factors; watershed condition relative to the species' environmental sensitivities; and the national forest role in the watershed. Possible viability outcomes are:

Outcome 1. Species occurs within watersheds with no impairment. Likelihood of maintaining viability is high.

Outcome 2. Species is potentially at risk in the watershed; however, Forest Service may influence conditions in the watershed to keep it well distributed. Therefore, likelihood of maintaining viability is moderate.

Outcome 3. Species is potentially at risk within the watershed; however, Forest Service opportunity to affect outcomes for the species in the watershed is limited. Therefore species viability in the watershed may be at risk.

Outcome 4. The species is so rare within the watershed (population is at very low density and/or at only a few local sites) that stochastic events (accidents, weather events, etc.) may place persistence of the species within the watershed at risk. Forest Service may influence conditions in the watershed to keep the species relatively secure. Therefore, likelihood of maintaining viability is moderate to low.

Outcome 5. The species is so rare within the watershed (population is at very low density and/or at only a few local sites) that stochastic events (accidents, weather events, etc.) may place persistence of the species within the watershed at risk. Forest Service ability to influence the species is limited. Therefore species viability in the watershed may be at risk.

Viability outcomes for species on the Sumter National Forest are given in Table 3-70.

Table 3-70. Viability outcome in watersheds on the Sumter National Forest.

		Viability Outcome (Number of Watersheds)					Total
COMMON NAME	**SCIENTIFIC NAME**	**1**	**2**	**3**	**4**	**5**	**Watersheds**
Brook floater	Alasmidonta varicosa		4				4
Oconee stream crayfish	Cambarus chaugaensis		2				2
Carolina darter	Etheostoma collis	1		12			13
Rayed pink fatmucket	Lampsilis splendida			1			1
Carolina heelsplitter	Lasmigona decorata		3				3
Robust redhorse	Moxostoma robustum		3				3
Non PETS Species		3	1	5			9

Non-Native Species

Affected Environment

A multitude of non-native species including non-native plants, insects, and pathogens threaten the integrity of native ecosystems in the southern Appalachian area. These include, but are not limited to, numerous invasive plant species such as kudzu, privet, Japanese honeysuckle, and Nepal grass. The Southern Appalachian Assessment (SAMAB 1996) provides a summary of the major threats from invasive non-native invasive plant pests (pp.121-122). The occurrence of invasive non-native plants continues to increase. Results from FIA plot data, one of the few Regionwide and longer-term inventories in the south, showed that privet (*Ligustrum* sp.) occurrence nearly doubed to 5% between the 1980 and 1990's, and Japanese honeysuckle (*Lonicera japonica*) was prevalent, occupying 20% of the landscape. Kudzu (*Pueraria lobata*), a federally noxious weed first introduced in 1935, today costs farmers and woodlot owners $100 million/annually to control.

On the Sumter National Forest, invasive non-native plant species being tracked through project level inventories, including kudzu, tree of heaven (*Ailanthus altissima*), autumn and Russian olive (*Elaeagnus sp.*), English ivy (*Hedera helix*), sericea lespedeza (*Lespedeza cuneata*), privet, Japanese honeysuckle, Nepal grass (*Microstegium vimineum*), chinaberry (*Melia azerdarach*), multiflora rose (*Rosa multiflora*), Chinese wisteria (*Wisteria sinensis*), and mimosa (*Albizzia julibrissin*). While other invasive plant species may occur with scattered distributions on the forest, these species are recognized as having significant occurrences with a high potential for impacts to native communities on the forest.

Direct and Indirect Effects

In 1999, the Southern Region released a Noxious Weed Management Strategy that outlined five emphasis areas, 1) Prevention and Education, 2) Control, 3) Inventory, Mapping, and Monitoring, 4) Research, and 5) Administration and Planning. This was followed in 2001 with the development of the Regional Forester's Invasive Exotic Plant Species list. A federal executive order issued by President Clinton charges federal landowners to prevent the introduction and spread of invasive species. Forestwide standards which address the control of species on the Regional Forester's invasive non-native plant species list includes the control of non-native species where they are causing adverse effects to rare communities, federally-listed species, or species where viability is a concern, and forestwide standard prohibiting the seeding of invasive non-native species. Forest Plan Goal 14 is to minimize adverse effects from non-native invasive species. Activities in the Revised Plan which result in soil disturbance and increased light availability in proximity to known non-native invasive plant populations, has the potential to increase the potential for spread of these populations. This potential for spread would be highest under Alternatives A, D, F, and I, and lowest under B and G.

Negative effects from non-native species will be less, compared to current management, under all Plan alternatives through the implementation of the above goal and standards.

The National Forest is increasing emphasis on the treatment of invasive species above current management across all alternatives, with highest acres of control predicted under Alternative B, followed by Alternative I. Table 3-71 displays the probable acres of invasive plant control across alternatives.

Table 3-71. Acres of Probable Annual Non-native Invasive Plant Control on the Sumter National Forest, by Alternative

Treatment	Unit	Alt. F (Current)	Alt. A	Alt. B	Alt. D	Alt. F	Alt. G	Alt. I
Invasive plant control	Acres	50	500	1250	500	250	250	750

Cumulative Effects

With an increased emphasis on the management of non-native species in the Southern Appalachian area, particularly plant species, it is expected that the cumulative impacts from invasive non-native species will be reduced across all alternatives, compared to current management. The high rates of growth and expansion of invasive non-native plants, including those on private land ownerships occurring adjacent to the forest, will continue to make control of non-native invasive plants on federal land a large and expensive challenge.

Forest Cover

Affected Environment

Tree species are inventoried as forest stands and classified by forest cover type. A forest stand is defined as a group of trees occupying a specific area. A stand has relatively uniform species composition, age arrangement, and condition so as to be distinguishable from other adjoining areas.

Forest cover type is a classification that identifies the tree species whose crowns dominate a forest stand. Forest cover types with single species tree names do not represent pure stands of that tree species. Up to 30% of a stand may contain other tree species while retaining the single tree species name. Stands that have several tree species with no single species comprising 70% or more of the stand are classified as mixed cover types.

The cover types on the forest can be grouped into general types. Stand ages are equally important to the structure and function of the forest cover as the forest type. General types and age class distributions are shown in Tables 3-71 and 3-72 below. The acreages in the following tables are based on the Continuous Inventory of Stand Conditions (CISC) database, and do not include recent acquisitions such as the Jocassee tract.

Table 3-71. Forest Types and Age-class distribution in the ***piedmont*** *(Enoree and Long Cane Ranger Districts) of the Sumter NF, 2002.*

Forest Type	Age Class (by acres)						
	0-10	11-20	21-40	41-80	81+	Total	%
Loblolly pine*	15,509	39,719	51,127	89,053	5,537	200,945	74
Shortleaf pine	5	0	247	2,325	431	3,008	1
Mixed Hardwood and Pine•	102	442	794	5,398	2,090	8,826	3
Upland Hardwood	59	377	261	19,803	11,407	31,907	12
Bottomland Hardwood	12	631	463	11,904	12,227	25,237	9
Total acres	15,687	41,169	52,892	128,483	31,692	269,923	
% of Total	6	15	20	48	12		

* Includes small acreages of Virginia pine and longleaf pine

• Includes both majority hardwood and majority pine mixed types

Table 3-72. Forest Types and Age-class distribution in the ***mountains*** *(Andrew Pickens Ranger District) of the Sumter NF, 2002.*

Forest Type	Age Class (by acres)						
	0-10	11-20	21-40	41-80	81+	Total	%
Hardwoods	108	940	863	3,040	15,727	20,678	27
Mixed Hardwood and Pine*	898	78	353	5,704	18,736	25,769	33
Shortleaf pine, pitch pine, Virginia pine	526	2,967	1,100	4,076	7,245	15,914	20
Table mountain pine	0	0	0	46	0	46	0
White pine	75	535	3,527	1,732	2,633	8,502	11
Loblolly pine	0	479	5,802	474	0	6,755	9
Total acres	1,607	4,999	11,645	15,072	44,341	77,644	
% of Total	2	6	15	19	57		

* Includes both majority hardwood and majority pine mixed types

Loblolly pine is the dominant tree species on piedmont uplands. It also occurs in bottomlands, and grows on a wide variety of landforms. Common tree species associated with stands of loblolly pine are sweetgum, oaks, hickories, dogwood, red maple, yellow-poplar, and numerous others.

Bottomland hardwoods are the primary component of floodplains along piedmont creeks and streams. These forest types are commonly mixtures of sweetgum, green ash, sugarberry, river birch, sycamore, cottonwood, red maple, willow oak, water oak, laurel oak, cherrybark oak, swamp chestnut oak, and yellow-poplar.

A large percentage of the upland hardwoods and mixed hardwood and pine stands in the piedmont are on the slopes near smaller streams.

In the mountains, the majority of the forest (57%) is over 80 years of age.

White pine has been increasing over time in the southern Appalachian Mountains.

Acreages of shortleaf pine and pitch pine are declining throughout the southern Appalachian Mountains. Similarly, table mountain pine has declined throughout the southern Appalachian Mountains to the point where it is now considered a rare community.

The Andrew Pickens Ranger District is outside of the native range of loblolly pine. Approximately 6,800 acres of loblolly pine are established there.

Early successional forest (age 0-10) is 5% of the piedmont forested acreage and 2 % of the mountain forested acreage in 2003.

Direct and Indirect Effects

Changes in age class distributions over time are addressed under successional habitats. Effects of the alternatives on extent of table mountain pine are discussed under rare communities.

Over the next several decades, the amount of forest in hardwood types should increase under all of the alternatives considered, given the desired conditions of the management prescriptions. Hardwood cover from most to least should be approximately as follows by alternative:

MOST B G I E A D F **LEAST**

Alternative B has the most restoration (9G2 and 9H) prescriptions. Alternative G has a substantial piedmont area in the 9G2 management prescription, and much or most of the shortleaf pine and pitch pine in the mountains will become hardwood through succession. Over time, however, much of the mountains will also or in turn succeed to white pine. Alternative I has a substantial part of the piedmont in the 9G2 management prescription. The slopes of areas allocated to prescription 9A3 will tend to succeed to hardwood types over time. The desired conditions of 8A1 and 7E2 will also promote more hardwood cover over time. Alternative E will have limited amounts of hardwood types in the extensive allocation of management prescription 8B2. The desired condition in prescription 7E2 will promote more hardwoods, as will succession in prescription 12A and the old growth prescriptions.

The amount of shortleaf pine and pitch pine in the mountains would be relatively static under management prescriptions such as 7E2, 8A1 and 10B. Although the intent of 9H indicates static to increased amounts of shortleaf and pitch pine, the low limits for early successional habitat will reduce the extent of shortleaf and pitch pine for this management prescription.

It will increase under each of the alternatives that convert loblolly pine to more native species, since most of these sites are not mesic. Management prescriptions with low levels of tree harvest would maintain less shortleaf pine and pitch pine in the mountains. Alternatives with more prescribed fire will tend to maintain more of these species. Table 3-73 shows the relative amounts of shortleaf and pitch pine in the mountains by alternative.

Table 3-73. Relative amounts of shortleaf and pitch pine in the mountains by alternative.

MOST	
D	2nd most area in active management allocations. 2nd least area lost due to succession. Has loblolly pine conversions.
I	3rd most area in active management allocations. Next least area lost due to succession.
F	Least area lost to succession, but is the only alternative with no loblolly pine stands converted.
A	Slightly more area than E allocated to prescriptions with active management. Alternative A has about the same amount of prescribed burning in the mountains as Alternative E.
E	
B	Stronger desired condition in 9H management rx, but more old growth allocations add to the amount that will be lost through succession. Limited 1-3% early succession means that much of shortleaf pine and pitch pine in 9H will be lost through succession.
G	Most of the shortleaf pine and pitch pine would be lost to succession over time due to little active management. Would maintain far less of these species than any of the other alternatives.
LEAST	

In the piedmont, Alternative B would restore more shortleaf pine than any other alternative. Alternative I would restore the next most. Alternatives E and G follow I, with both E and G increasing piedmont shortleaf pine about equally. Alternatives A, D and F would not increase the acreage of piedmont shortleaf pine from current levels.

As noted under the affected environment, the amount of eastern white pine has been increasing over time in the southern Appalachian Mountains. Since white pine is shade tolerant, it will tend to increase over time in the absence of harvest. It will also tend to increase over time in the absence of prescribed fire, both because of its shade tolerance, and because young white pine are readily damaged or killed by fire. Table 3-74 shows the relative amounts of white pine by alternative.

Table 3-74. Relative amounts of white pine by alternative.

MOST	
G	Most undisturbed succession.
B	Large 9H restoration prescription has intent to reduce white pine, but low amounts of regeneration permitted will leave much white pine on landscape.
E	
I	More area allocated to active management in the mountains than Alternative E.
A	A, D, and F all have higher harvest levels with 10B allocations. Allows more removal of white pine. Relative ranking of A, D, and F is by area in 10B allocation in the mountains.
D	
F	
LEAST	

<u>The amount of loblolly pine forest cover</u> will decrease under all alternatives, given the desired conditions of the management prescriptions. All of the loblolly pine in the mountains will be converted to more native species under all alternatives except Alternative F. Loblolly pine cover from most to least should be approximately as follows by alternative:

MOST	F	D	A	I	B	**LEAST**
				E	G	

Alternative F would maintain more acreage in loblolly pine forest than any of the other alternatives. It has the largest allocation of management prescription 10B, is the only alternative that does not include management prescription 11 for riparian corridors, and would not convert the loblolly pine forest type in the mountains. Alternatives D, then A have the next largest 10B allocations in the piedmont. Alternatives E and I should have similar amounts of loblolly pine, as would Alternatives B and G.

<u>Stand densities</u> are an important aspect of forest cover. As modeled in SPECTRUM, Alternative B shows a probable activity of approximately 5,000 acres of thinning in the first decade. Alternatives E, F, and I would have approximately 3,000 acres of thinning each. The remaining Alternatives show probable activities of approximately 2,000 acres of thinning each.

According to the desired conditions in management prescriptions, one would expect Alternative G to have the most extensive areas of dense forest, since it has the most extensive allocations of management prescriptions with low levels of timber harvest. Alternative E presents the other extreme, with a large allocation to management prescription 8B2. Most of this area should be in a woodland condition: open park-like stands with very low densities. Once an area is thinned under this prescription, it should remain open for a long period. The extent of this allocation is probably beyond our ability to maintain the desired conditions. Alternative B has a substantial acreage allocated to management prescription 8B2 also, but much less than Alternative E. Because regeneration is very limited in Alternative B, management activity would focus on thinning harvest resulting in substantial amounts of forest with moderate to low stand densities. Alternatives F and I have similar levels of thinning in the Spectrum model. In turn, these are relatively higher than projected acres of thinning for Alternatives A and D, which are similar to each other. As just discussed, relative stand densities from most dense to most open should be approximately as follows by alternative:

DENSE	G	A	F	B	E	**OPEN**
		D	I			

Cumulative Effects

Eastern white pine is gradually increasing in extent through most of the southern Appalachian Mountains. Cumulatively, it is an important trend. Alternatives that take measures to counter this trend are positive in the larger context.

The abundance of shortleaf pine and pitch pine has been decreasing through the southern Appalachian Mountains and the piedmont for many years. Natural succession, southern pine beetle outbreaks and other insects and diseases continue to reduce the numbers of these species. The southern pine beetle outbreaks of 2000 – 2002 killed large acreages of shortleaf pine and pitch pine in the mountains of Tennessee and North Carolina. In this context, maintaining these species takes on more importance. Private land owners in the piedmont region have long discriminated against shortleaf pine because of its relatively slow growth compared to loblolly pine, and because of problems with littleleaf disease. Given the pronounced absence of shortleaf pine on most private lands, the decreasing abundance of these species across all ownerships, and the habitats these species provide, the cumulative effects of managing for these species are important.

The state of South Carolina has more standing hardwood volume than softwood (South Carolina's Forest Resources-----2000 Update, Southern Research Station, Resource Bulletin SRS-65). Extent of hardwood cover does not seem vital in the cumulative sense. However, the (South Carolina) area in oak-pine dropped from 1.9 million acres to 1.4 million acres, and the area in oak-hickory forest type group declined 4%.

Forest Health

Affected Environment

Insect and disease organisms are an important component of forest ecosystems. Native organisms contribute to many ecological processes of forests including nutrient cycling, plant succession, and forest dynamics. In most cases, these native organisms are recognized as an integral component of forest health. In a few instances, however, these organisms cause unacceptable resource damage or loss, and adversely affect ecological, economic, or social values. In these cases, the organisms causing the damage are referred to as pests. Principal native insect pests on the Sumter National Forest include the southern pine beetle and a variety of defoliators. Primary native disease problems include oak decline, annosum root disease, and a variety of other decay organisms affecting living trees.

Throughout the past 100 years, a variety of insects, diseases, and plant species have been introduced to the United States and spread into the Sumter National Forest. These non-native organisms are often pests because they often have no natural enemies or other naturally controlling agent and their unchecked spread can wreak untold damage to native ecosystems and forest communities. Chestnut blight has reduced the American chestnut from the dominant hardwood tree species in the mountains to a minor understory component of today's forests. Other important non-native pests include hemlock woolly adelgid, littleleaf disease, butternut canker, and dogwood anthracnose. Gypsy moth will probably reach the Sumter within the next few decades.

The European gypsy moth (*Lymantria dispar*), is a major defoliator of deciduous hardwood forests. It was first introduced from Europe into Massachusetts in 1869, and because the favored host, oak, is widespread in the eastern deciduous forests, it thrived and continues to expand its range west and south each year. It is established throughout the Northeast, and the infested area extends from New England, south into Virginia and North Carolina, west into Ohio, and includes all of Michigan. As the infested area expands, the frequency of accidental introductions of gypsy moth on the southern Appalachian area national forests will increase. Accidental introductions of gypsy moth may lead to the use of insecticides to eliminate (or eradicate). The continued implementation of the Gypsy Moth Slow the Spread Project (STS) will probably delay the permanent establishment of gypsy moth on the Sumter NF. However, STS will not stop the spread of gypsy moth.

Gypsy moth larvae feed on more than 500 species of trees, shrubs, and vines. Favored hosts include oak, apple, birch, basswood, witch hazel, and willow. Hosts moderately favored by gypsy moth include maple, hickory, beech, black cherry, elm, and sassafras. Least favored hosts include ash, yellow poplar, American sycamore, hemlock, pine, black gum, and black locust. Late instar larvae can feed upon tree species that younger larvae avoid, such as hemlock, maple and pine. Feeding on less favored host plants usually occurs when high density larval populations defoliate the favored tree species and move to adjacent, less favored species of trees to finish their feeding and development.

Defoliation by the gypsy moth may reduce tree vigor, reduce growth of shoots and stem, cause dieback of the crown, trigger a failure of hard mast production, and sufficiently weaken a tree such that it is attacked and killed by wood boring insects and root decay fungi. Hardwoods in a vigorous condition often can tolerate a year or two of defoliation before canopy dieback becomes pronounced. However, hardwoods that are stressed by drought, oak decline, or some other factor tolerate defoliation less well. The damage caused by gypsy moth feeding in spring is harmful because trees must draw upon reserve carbohydrates and nutrients to produce a second canopy of leaves following defoliation (a process referred to as refoliation). Generally, a tree refoliates when approximately 60% of its canopy is consumed. Production of a new set of leaves following defoliation restores the photosynthetic capability of a tree's canopy, however, the refoliation process draws upon nutrient reserves that would be used for shoot growth and foliage production the following spring. The refoliated canopy is not able to fully replace the nutrients and stored reserves mobilized by the tree during refoliation, leaving the tree in a weaker condition the following spring. As a result, trees exposed to repeated defoliation and refoliation are weaker and more susceptible to attack by wood-boring insects and root-decay fungi.

Once established, gypsy moth population densities fluctuate widely from year to year resulting in episodes of dramatic and severe defoliation followed by periods of relative innocuousness. At low densities, the gypsy moth is regulated, but not eliminated, by natural enemies such as parasitic insects and predaceous vertebrates, particularly small mammals. As populations increase beyond the control of these natural enemies, the gypsy moth is regulated by different mortality factors, primarily diseases and starvation. Of these two factors, diseases caused by the nucleopolyhedrosis virus (gmNPV) and the gypsy moth fungus (*E. maimaiga*) lead to the collapse of outbreak populations of gypsy moth. At the forest stand level, the period between outbreaks may range from 2 to 5 years and the actual outbreak period may range from 1 to 3 years. On a region-wide basis, gypsy moth populations develop to outbreak levels across wide areas of the northeast, mid-Atlantic, and Lake States for a period of years and then drop to very low levels for several years. Factors regulating these regional outbreaks and collapses of gypsy moth populations are not well understood.

The hemlock woolly adelgid, *Adelges tsugae*, an insect species native to Asia, was first identified in the eastern United States in 1924 in Richmond, VA, but it has recently expanded into the Southern Appalachians and threatens to spread throughout the ranges of eastern and Carolina hemlock. It has recently become established along the Chattooga River and the East Fork of the Chattooga. The adelgid may be spread by wind, birds, or mammals (McClure 1990).

Non-native invasive plants known to occur and currently impacting the Sumter National Forest include Japanese and Chinese privet, kudzu, sericea lespedeza, Japanese honeysuckle, wisteria, microstegium, ailanthus, autumn olive, multiflora rose, Chinaberry, and mimosa. Invasive non-native plant species can spread into and persist in native plant communities and displace native plant species, posing a threat to the integrity of the natural plant communities.

The high percentage of relatively older forest communities in the mountains poses challenges in addressing forest health issues. Approximately 57% of the forested acreage in the mountains is over 80 years of age. These large areas of mature forests are particularly vulnerable to both native and non-native forest pests. Oak decline is a primary concern in mature oak forests. Currently, there are approximately 58,000 acres of upland oak and oak/pine types on the Sumter.

Oak decline is a complex disease involving interactions between environmental and biological stresses and subsequent attacks by secondary pests. The disease generally progresses slowly over several years. It begins with a long-term predisposing stress such as prolonged drought or advanced age. These stressed or older trees are often subsequently damaged by short term inciting factors such as insect defoliation, spring frosts, or acute drought. In their weakened condition, these trees may be attacked by insects and diseases that normally do not invade healthy trees. At this point, classic decline symptoms appear, beginning as dieback from branch tips inward and ultimately resulting in the death of the tree. The most important underlying factor when resource damage is severe may be a tree population dominated by senescent overstory oaks lacking vigor. (Oak, et. al. 1991).

Stand and site factors that determine oak decline risk include forest type (oak density), site productivity (site index), age, and stress factors such as spring defoliation and drought or combinations of these stresses (Oak and Croll 1995). The highest risk conditions are stands with a large oak component (especially red oak of advanced age), growing on sites of average or lower productivity, with a recent defoliation history and prolonged growing season drought. Risk may be reduced by reducing stand age through regeneration harvests, altering species composition through thinning (reduce or eliminate oak component), and/or preventing stress factors (treating spring defoliating insects with insecticides is the only feasible option but is often not economically justifiable).

In the piedmont, the Sumter National Forest has large acreages of loblolly pine that are mature, making them more susceptible to natural senescence, littleleaf disease, and southern pine beetle.

Shortleaf pine is the most seriously damaged host of littleleaf disease, with loblolly pine damaged to a lesser extent. On the Sumter National Forest, littleleaf disease occurs almost exclusively in the piedmont, where shortleaf pine or loblolly pine are growing on eroded clay soils with poor internal drainage. Hardwoods are not affected.

A complex of factors cause littleleaf disease. These include the fungus *Phytophthora cinnamomi*, low soil nitrogen, and poor internal soil drainage. *Phytophthora cinnamomi* is a fungal pathogen of feeder roots. Its development is promoted by poorly drained soils. The first symptoms of littleleaf disease are those of nutrient deficiency; a slight yellowing and shortening of the needles and reduction of shoot growth. In the later stages of the disease, the symptoms become progressively more distinctive. The crown of an infected tree appears thin and tufted. New needles are discolored and shorten than normal, and the tree loses all but the new needles near the tips of the branches. Branches begin dying, starting in the lower crown and progressing upward through the crown. The disease rarely occurs in young trees, and becomes increasingly severe in older stands. This is one reason that it is often inadvisable to carry piedmont pine stands to advanced ages.

Littleleaf disease is closely tied to past land use. Agricultural use followed by land abandonment and subsequent erosion during the 19th and early 20th century resulted in concentrations of littleleaf disease in southeastern Piedmont of Virginia, North Carolina, South Carolina, Georgia, and Alabama with smaller areas of scattered disease in southeastern Tennessee and Kentucky.

Southern pine beetle (SPB) (*Dendroctonus frontalis*), infestations have occurred cyclically throughout recorded history in the South. SPB outbreaks move from low levels of infestation to high levels over several years. The cycles may be localized or regional and depend upon weather and other stress factors as well as the interrelationship between the populations of SPB and its predators.

The female SPB kills conifers by boring under the bark and destroying the cambium layer of the tree. They construct winding galleries while feeding and laying eggs. During outbreaks, trees are usually mass-attacked by thousands of beetles. The crowns of trees attacked by SPB during warm dry weather may fade in color within weeks. Once a tree is successfully attacked the tree usually turns light greenish-yellow, then yellow, and finally reddish-brown. This color change pattern can vary depending on tree, and environmental conditions.

The Sumter is currently experiencing a southern pine beetle (SPB) epidemic, resulting in substantial mortality to pines. SPB infestations have grown especially fast in dense forests. Higher stand densities make pine stands much more susceptible to SPB attack, and point to the need for maintaining these stands at moderate densities.

Pitch pine, shortleaf pine, and table mountain pine are declining in abundance throughout the southern Appalachian Mountains. This is due to age, southern pine beetle outbreaks, lack of fire, and limited amounts of disturbance.

Fire has historically played an important role in shaping the species composition of the Sumter National Forest. Historically, relatively frequent fires have maintained and restored many forested communities across the piedmont and Southern Appalachians, especially Xeric Pine and Pine-Oak Forest; Dry and Xeric Oak Forests; and Dry and Dry to Mesic Pine-Oak Forests. Without fire or other vegetation management actions that approximate fire effects, many communities may decline dramatically in future years and shift towards shade-tolerant and fire-intolerant species. In the mountains, the absence of somewhat frequent fire has allowed fire dependent table mountain pine to decline to where it is now considered a rare community.